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Contents.

	PAGE
Some Reflections on the American Visit	195
Visit of the American Foundrymen's Association	194
A Note upon Cast Iron for Marine Engine Castings	195
An Apprenticeship Course in Foundry Practice.—LVII.	198
"Moulders" of the Industry.—No. 15	200
Assembling a Metallurgical Laboratory	201
Farington Steel Foundry	203
Honeycomb Structure in a Piece of Mild Steel	206
A.F.A. Committee on Specifications for Malleable Castings	205
Quantity of Heat	206
Correspondence	206, 212
Eliminating Unseen Wastes of the Foundry	207
The Paris Foundry Exhibition	208
Recommendations for Supplying Pig-iron on Analysis	214
An Interesting Competition	214
Trade Talk	214
Institute Notes	214
Iron and Steel Markets	216
Personal Paragraphs	218
Company News	218
Gazette	218

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION

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Some Reflections on the American Visit.

Last week we made reference to the potential results of the visit of the delegates of the American Foundrymen's Association and the International Congress, which opens in Paris next Wednesday. Since that time we have had further opportunities of obtaining additional expressions of views from the visitors.

Americans who have had the occasion to peruse the tentative specification prepared by the Test-bar Committee of the Institute of British Foundrymen, under the chairmanship of Mr. J. Shaw, of Sheffield, are generally in favour of the adoption of the medium size test-bar as an International Arbitration Bar. The Fremont method of tapping small bars from the casting does not appeal to them, as they state the strength of a piece of cast iron varies according to the depth. However, in Paris, opportunity will be given for the fullest expression of views in a discussion to take place on a very important Paper which Dr. Moldenke is to present relative to this subject. Additionally, both the Fremont baby transverse and shear testing machines will be on view in the educational section of the Exhibition for examination.

Uppermost in the American mind seems to be the question of selling pig-iron to analysis. Apparently for some purposes they prefer British pig-iron, but they would like something more definite than a fracture grading. We understand that one prominent member is prepared to take the equivalent output of one blast furnace, providing a guarantee is given that the material supplied will fall between certain specified limits of chemical analysis. Thus are the American visitors helping us to solve our own problems, for the time is overdue when the foundrymen of the world should have something more tangible than a mere number. This subject may be nearer solution than is suspected, as we are aware that many ironmasters and merchants, though now only stating approximate analyses, actually do keep extremely near to the stated composition. It merely needs that a few firms of this calibre boldly announce their intention definitely to supply their irons to within guaranteed limits.

Wherever British and American foundrymen meet, conversation usually turns upon the topic of quantity production and the general success which the American foundryman has made of it, whilst the success of the British has only been spasmodic, but often highly successful. The general consensus of opinion appears to be that the following factors operate: the enormous American market, coupled with their craving after things new and novel; the British conservatism and their craving for quality; the dislike of the British workmen to pursue an occupation exhibiting little interest, and the great, vast supply in the States of emigrants from Southern and Eastern Europe who are quite content to engage in such operations. The Americans state that owing to the drastic restrictions on immigration, that this supply is totally unequal to the demand, and they are now striving further to mechanicalise industry. This will involve additions to their already extensive conveyor systems, which are apparently a success in the States, and, generally speaking, a failure here. Just so long as female labour can be employed the British are just as competent as the Americans at quantity production. Though these fundamental principles are well understood, the actual accomplishment is still difficult, especially the amassing of orders sufficiently large as to enable it to become the dominant factor here, as it seems to be in the States.

Visit of the American Foundrymen's Association.

SHEFFIELD VISITED.

The visit to Sheffield of the delegation of the American Foundrymen's Association has provided the visitors with an opportunity to see some of the things Sheffield is capable of doing and some of the plant that is available for the very highest type of steel and foundry work. Members of the delegation were impressed with all they saw, and stated publicly and privately their appreciation of the work they had seen both at Hadfields' East Hecla Works and at Edgar Allens' establishment. The only regret the hosts had was that they were unable to show the visitors all the plant in working order. Unemployment due to bad trade, has left many of the shops with only a handful of men engaged, in contrast to the American foundries, where, one of the visiting delegates stated, there is a shortage of labour.

Works Visits.

At Hadfields the visitors were entertained to lunch by the directors, and Sir Robert Hadfield came up specially from London to preside. The toasts of "The King" and "The President of the United States" were drunk with enthusiasm.

SIR ROBERT HADFIELD, in proposing the health of the visitors, said he was sorry the American delegation had come over when things were so bad in the trade of the country. However they had confidence that things would improve, and that improvement was long overdue. There was a tremendous amount of unemployment. There were still about one and a half million people out of work, but they were all putting their shoulders to the wheel and doing their best to mark time until better trade came along. A hundred years ago the country had a population of only 14 million. To-day it was about 42 million. We had a serious problem to face to regain our industrial prosperity. He felt sure the Americans did not grudge Great Britain her place in the industrial world. (Hear, hear.) Competition among nations was all to the good and did not interfere with friendship. He owed much to the assistance that had been given to him in America by scientists and steel manufacturers whenever he visited that country. Referring to the general question of trade, Sir Robert pointed out that whilst Russia was in its present position European trade could not assume pre-war dimensions. Only when Russia was placed on her feet again could we expect to get European trade on a proper basis. It seemed to him that where one part of a continent was in a non-prosperous state it was impossible for the other parts not to suffer.

MR. G. H. CLAMER, President of the American Foundrymen's Association, in reply, said this was the first time he had been in England, and whilst he had been disappointed in some things he had seen for the first time—notably London Bridge—Hadfields works had gone far beyond his expectations. He had never been in a works better laid out, or where the workers were employed under better conditions than at Hadfields. He congratulated the firm on having a plant which the delegates could go back to America and describe in enthusiastic language to their fellow countrymen.

During the afternoon the party visited the extensive works of Messrs. Edgar Allen and Company, where again they saw many interesting things, though, of course, necessarily on a limited scale, owing to the bad trade. Subsequently they were entertained to tea, and thanks were voiced by MR. CLAMER. He paid special tribute to the high quality of workmanship that had been seen.

THE SHEFFIELD BANQUET.

In the evening the members of the delegation were entertained to dinner by the Sheffield and District Branch of the Institute of British Foundrymen. Mr. John Shaw presided, and amongst those present were Sir Robert Hadfield, the Lord Mayor of Sheffield (Ald. W. C. Fenton), the Mayor of Rotherham (Councillor Habershon), Mr. V. E. Minich (director of the A.F.A.), Dr. Richard Moldenke, Mr. T. H. Firth and Dr. Percy Longmuir.

The toast of "The King" and "The President of the United States" having been accorded musical honours,

THE CHAIRMAN, in a brief speech, extended a warm welcome to the delegates, and expressed the pleasure he and his colleagues felt at the visit of th delegation.

MR. V. E. MINICH, proposing the toast of "The City and Commerce of Sheffield," said that the name of Sheffield was known the world over when they in America were still in their swaddling clothes. The city was known to them in America for the pre-eminence of its manufacture of the finest cutlery in the world; and for the wonderful Sheffield plate. Sheffield to-day stood at the head of production of artistic plate, and the hall-mark of Sheffield was sufficient for anyone who wished the best. But the city's reputation was far greater than that. She was pre-eminent in the production of fine steels. The men of Sheffield had led the world in scientific research in the field of steel. It was there, too, manganase steel, high-speed tool steels, and stainless steels had been produced. Not the least thing that could be said of Sheffield was that she produced good wares, or she produced none. (Hear, hear.) If the world or the individual were not willing to buy good wares, they did not get Sheffield wares. (Hear, hear.)

THE LORD MAYOR, responding, drew the attention of the visitors to the many beauty and historical spots in the neighbourhood of the city, which he advised them to visit. He also recounted what the city had done for the country during the war, and how the concentration on war work had left them with a burden of unemployment. Alluding to the question of trade, he expressed himself in optimistic vein. Things were mending slowly, he said, and in the next half-year he hoped there would be a reduction in the rates, which would enable manufacturers of the city to compete on more favourable terms with their rivals in other parts of the world. They in Sheffield were justly proud of their city, but he thought they did not advertise themselves sufficiently. They could learn a lesson from the United States in that direction. Concluding, his Lordship drew the attention of the visitors to the city's excellent public services, and paid a tribute to the work of the Applied Science Department of the University in regard to industry.

Technical Co-operation.

SIR ROBERT HADFIELD—the oldest British member of the American Foundrymen's Association—in proposing the toast of the visiting Association, referred to the wonderful progress that had been made in the foundihg art and to the part the Universities and Technical Schools had played in that progress. Sheffield owed a debt of gratitude to its University and Technical Schools in that respect. It was important, he said, to bring science and practice together if they were to get sound advance, and not merely a mushroom growth.

"The world owes its great advance," he said, "to the scientific and technical men. If we were to take them out of our lives we would not have achieved those wonderful accomplishments we see about us.

"My one great desire in life," he concluded, "is to see England and America marching hand in hand on the lines of true progress, and the technical men can give great help in bringing that about."

England's Greatness.

MR. G. H. CLAMER, responding, said they had felt the hospitality of the Institute of British Foundrymen from the first minute of their arrival in England. "You Englishmen," he said, "do the little things so gallantly and so nicely, and you do

(*Continued on Page* 211.)

A Note upon Cast-Iron for Marine Engine Castings.*

By H. J Young, F.I.C., and E. Wood, B.Sc.

The result of prolonged experience of, and inquiry into, ironfoundry practice is to discover the fallacy and prejudice with which the trade abounds and to arrive at the position of being faced with the necessity for much research work upon a large scale; also one finds little data of value in practice.

This note touches briefly upon the more common difficulties of the work, as met by an engineer and chemist working in co-operation, in the hope that those having charge of designing may give the matter closer attention and increase the standard of castings generally.

FIG. 1.—GRAPHITE FROM CENTRE OF A 25-TON CASTING, 75 DIAS.

Beginning with pig-iron, the authors have observed that the actual brands used have little or no bearing upon the final result, provided that they are properly incorporated together. Certain unbranded pig-irons, marketed at elevated prices, command a big sale among foundrymen; these materials, as a rule, are ordinary cheap pig-irons of no outstanding merit.

It is sometimes necessary to use extremely expensive pig, but only when it is impossible to obtain cheaper iron of the same composition. Pig-iron of a certain fracture is said uniformly to produce cast iron of great fluidity and strength, in spite of the proved and admitted fact that the composition of the iron varies, but the writers have met no such phenomena and have seen no proof of the existence of such properties in any commercial brand of iron; moreover, their experience is that the fracture of a pig-iron is no more constant or reliable than is its composition.

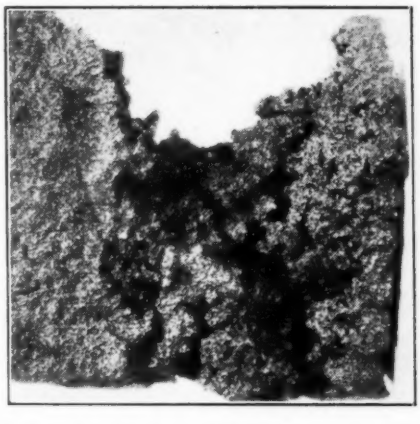


FIG. 2.—DRAW-IN TURBINE CASTING; ½ ACTUAL SIZE.

* A Paper presented to the Institute of Marine Engineers at the Olympia Exhibition.

Progress in the production of special cast iron can be made only by a study of composition, micro-structure and physical tests of sections cast under known conditions. Macro-structures may prove valuable but, at the moment they are unsatisfactory owing to the difficulty of producing reliable ones.

Use of Micrographs.

Graphite formation and distribution is best studied at one magnification only, otherwise it is extremely difficult to make comparisons. After many trials, a magnification of 75 diameters has been found very suitable. An inspection of the photographs given in this note will demonstrate the interesting part played by graphite in determining the properties of the cast metal. "Refined" graphite is frequently mentioned as a known condition, but a study of graphite at the above magnification does not reveal anything which can be described under the term "refinement." The form of the graphite and the extent of elongation, of continuity and of parallelism appear to be those factors governing the influence of any given amount of free carbon upon the physical properties of grey iron of any one composition.

FIG. 3.—GRAPHITE IN GOOD METAL NEAR DRAW, 25 DIAS.

FIG. 4.—GRAPHITE IN DRAWN METAL. MAGNIFIED 25 DIAS.

Pearlite has not thus far proved so interesting, by reason of the fact that the area which can be examined at any one time is so small. It is possible, at a magnification of only 400 diameters, to take photographs of apparently different types of pearlite from areas an infinitesimal distance apart. Moreover, the size of the pearlite appears to be largely determined by the

rate of cooling, and the effect of composition is not visible to the same extent as in the case of graphite.

In making the above general remarks, the desire is to be anything rather than dogmatic, and merely to point out such phenomena as have come to notice up to the present time.

Steam Cylinders and Turbines.

In the case of steam cylinders and large turbines the problem is to produce an iron strong and dense in the thickest parts of the castings whilst

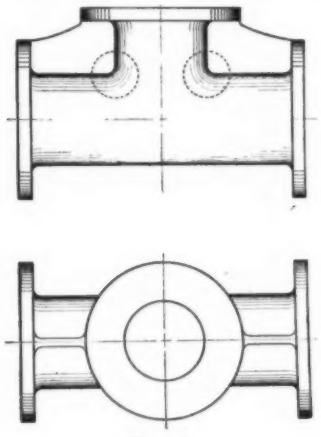


FIG. 5.

maintaining its greyness and good qualities in the thinnest ones. Frequently a flange is extended in order that test-bars may be cut from the extension piece, but when this is impossible and a large runner has been used to pour the mould, test-bars are cut from the runner.

Fig. 1 shows the graphite of the metal in the centre of a turbine casting of 25 tons weight, the metal where sample was cut being about 2½ in. thick. Castings of this mass—this particular one, after a week in the mould, was too hot to touch—are difficult to make of such material as will, in the actual casting, have both strength and density. The quality of big and heavy castings can be judged only by metal cut out of the castings themselves, or else from very thick test-bars cast in the same mould—the former method being the truly satisfactory test.

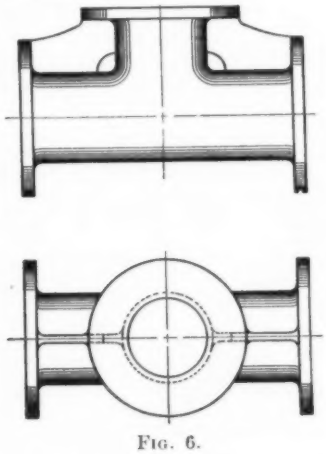


FIG. 6.

On certain large castings attached test-bars have been cast according to specification, but, owing to the particular requirements of our clients, the metal has been necessarily such that the cast-on bars have failed to give the required results, while bars cut from the castings themselves have given satisfactory tests and a grey fracture. Special liners for high temperature work, if made of suitable metal, generally behave as above.

Defects in Large Castings.

Large castings commonly have areas where two or more sections of different thicknesses meet together, with the result that, during solidification, the smaller section tends to "feed itself" from a larger one, the latter being yet liquid when the former has solidified. A typical defect of this character is illustrated in Fig. 2, the graphite of the good and bad parts being shown in Figs. 3 and 4 respectively. It is interesting to note that, by every means, it has been impossible to detect a difference between the structure of the "drawn" or bad part and that of the good part.

A Question of Design.

The above matter has an important bearing on the question of design, and is an aspect usually

FIG. 7.—DRAW-IN BOSS; 1-5 ACTUAL SIZE.

neglected, and sometimes unknown, by designers and engineering draughtsmen.

It is not unusual to find that the thickening-up of any one particular part of a casting, with the object of strengthening that part, has resulted in weakening it.

The draughtsman, when designing an important casting, should always consult the foundryman with a view to minimising the probability of draw-holes. A common source of this trouble is the solid rib frequently found on tee pieces, stop valves and steam cylinders. An example of it is shown in Fig. 5. The rib acts merely as a tie, and a better casting is produced if the rib is cored out at the junction of the two main surfaces, as in Fig. 6. When this is not done. "spongy" places occur at both sides of the ribs, owing to the latter "feeding" from the body of the casting.

An intricate mould requires metal of such quality as will make the thicker sections dense and strong, and, at the same time, run the thinner and more intricate parts of the casting. It is necessary, therefore, to avoid having thin parts running abruptly into thicker ones, or heavy

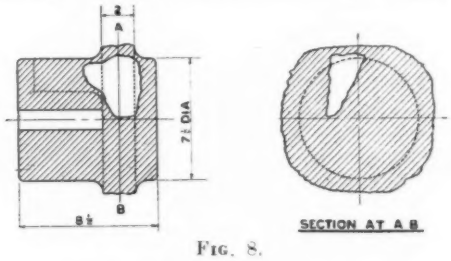


FIG. 8.

masses of metal due to the meeting together of several sections, or massive bosses and so forth.

Admittedly, it is not always possible to avoid these difficulties, but many designers do not attempt to do so, even where it would be easily possible.

Figs. 7 and 8 show a typical example of the above trouble caused, in this instance, by a heavy boss, in spite of the fact that a steel tube was inserted in the centre of the boss to mitigate the drawing effect. The design could be improved by coring out the solid boss, so that the thickness throughout is the same as that of the ribs and body of the casting. The suggested alteration, which would give a sound casting, is shown in Fig. 9.

When breaking up old cast iron propellers, it is frequently found that the blade has "fed"

from the boss, leaving the root of the blade and part of the boss hollow.

Another difficulty arises from the fact that the foundryman is often asked to make castings from which the cores cannot be withdrawn after the castings are made. There raises constantly the question of having an additional hole put in here, or an alteration there, to facilitate the cleaning of the castings or the proper venting of the cores; this is particularly noticeable in the new designs for marine oil-engine work.

If it were possible to break up and examine most so-called perfect castings, it is probable that the majority of them would exhibit internal defects which, if visible, would have been sufficient to condemn the castings. An examination of a heap of machinery scrap-iron will verify the truth of this statement. This scrap consists of broken-up

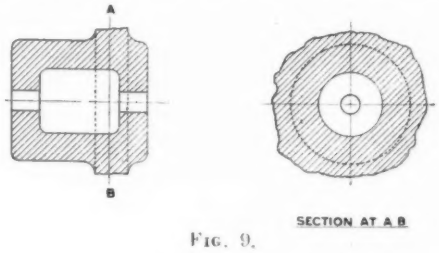


FIG. 9.

and worn-out machinery parts, and time is well spent examining the defects exhibited by these broken castings. In this manner it may be demonstrated to draughtsmen that many troubles arise as the result of faulty designs. In the event of engineering requirements becoming any more severe, it will be necessary to have drawings of important parts scrutinised by a draughtsman, fully trained in foundry practice and moulding.

The idea that one may, with impunity, make any part solid, or core it out, or thicken it up, or thin it down, or put in or take out a rib and so forth, is entirely erroneous so far as grey cast iron is concerned. Any such operation, carried out by people unskilled in foundry practice, frequently causes an entirely opposite result to that

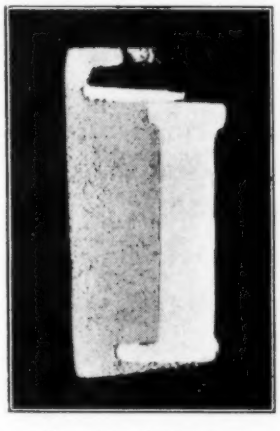


FIG. 10.—CHAPLET IN CASTING. ACTUAL SIZE.

desired, and gives rise to enormous difficulties in the foundry and machine shops.

Danger from Chaplets.

Chaplets, used for supporting and holding up the cores of a mould, are the contributory cause of many defects, and, although their use is generally unavoidable, it is a fact that they should be inserted only when essential, and then as sparingly as possible. Great improvements are possible in the form of chaplets and in the material of which they are made. Chaplets will sometimes produce blowholes and sponginess; they are apt to retain some of the gases and slag passing them, and unless the surface of the chaplet is smooth, clean, and free from gas-producing substances, porosity and gas-holes will arise.

If the chaplet is thin enough to melt in the hot iron, it may collapse; on the other hand, if it is sufficiently thick to resist the hot metal, then frequently it does not unite with it at all. Fig. 10

FIG. 11.—JUNCTION BETWEEN CHAPLET AND CASTING. MAGNIFIED 25 DIAS.

illustrates the latter case, and Figs. 11 and 12 show the entire lack of fusion between the cast iron and the chaplet. The slag trapped by the head of the chaplet is shown in Fig. 13.

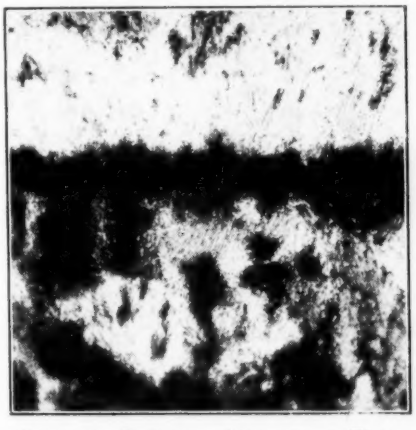


FIG. 12.—SHOWING ABSENCE OF WELD BETWEEN CASTING AND CHAPLET.

A big and awkward job may sometimes be simplified by making it in two or more pieces. This avoids the risk of an expensive casting being

FIG. 13.—SLAG AROUND HEAD OF CHAPLET MAGNIFIED 150 DIAS.

scrapped for a fault in one part, and reduces the time required for making, although it may entail more machining.

(To be continued.)

An Apprenticeship Course in Foundry Practice.—LVII.

By Ben Shaw and James Edgar.

CUPOLA PRACTICE.—METAL MIXTURES.—I.

Apprentices and young journeymen rarely have the opportunity of coming directly into touch with work entailed in the charging of the cupola, and it is unusual for them to have anything to do with the method of charging or the composition of the metal that is charged. This is unfortunate in many respects, as undoubtedly inexperience in this important part of foundry practice is the frequent cause of retarding the progress of otherwise capable moulders. If the executive positions demanded moulding skill only the competition to fill them would be keener than it is, because many who possess moulding skill to a very high degree are discouraged owing to lack of experience with the cupola. It must be remembered that however carefully a mould is made the quality of the casting obtained from it depends to a considerable extent on the character and quality of the metal of which it is composed and, to become a qualified foundryman, it is essential that consideration be given to melting appliances, the best method of charging them and to the various forms of pig-irons and scrap from which suitable mixtures can be made for the class of casting desired. As a rule, no facilities are given for obtaining information of this kind, but all apprentices who are really interested and keen on their work find means for getting some information. The opportunities may be few—they vary in foundries—but such information is obtained by observation and also by displaying a discreet form of inquisitiveness. Obtaining information of real value in this way is frequently very difficult, and some foremen discourage the practice. It would be much better and more satisfactory to both employer and apprentice if facilities were given for obtaining the requisite information on metal mixtures and cupola charging. If facilities were given to those who proved their capacity by displaying intelligence and skill in their work as apprentice moulders it would do much to encourage them. Whilst actual experience is desirable, the amount that can be obtained from any one foundry is limited to the methods adopted and to the variations of mixtures that may be necessary in that foundry. With a limited demand for varying mixtures, so will the information obtained be limited. The purpose of this article, therefore, is to supplement the information of those who have had some little experience and to give general information to those not so fortunate, but who may use it to good purpose should they get the opportunity.

In determining the suitability of pig-irons and scrap for a mixture two methods are adopted, one by fracture and the other by chemical analysis. Each method has its strong adherents, but there should be little difficulty in determining which gives the greater satisfaction.

Determining the Character of Iron by its Fracture.

This method of making up a mixture depends upon the qualities exhibited by the fracture of the pig and scrap used to make up the charge. It is the oldest method, and irons are placed in a category varying with the individual according to the colour and closeness of the texture shown by the fracture. The softest and weakest iron is determined by its open texture, grey colour, the manner in which the fingers are marked when rubbed over the fracture, and the ease by which it is broken. Between this and a hard white iron, which is almost white in colour, has a close texture, will not mark the fingers, and is not easily broken, are various grades which possess qualities that are characterised as soft, moderately soft, tough, tough and strong, moderately hard and very hard. In addition to fractures from which these qualities are obtained with varying degrees of accuracy, the qualities of the particular brands of pig-irons are more or less known, and the fractures only assist to bear out the qualities generally credited to the particular pig. The hematites, for instance, are strong, tough irons, and according to their numbers are not too difficult to machine. They are generally low in phosphorus, and therefore lack the fluidity this element imparts. Cold-blast iron is also strong and tough, and is generally harder than hematite of similar number. It is more difficult to machine and is more readily chilled than hematite. Another factor that must be remembered in connection with cold blast irons is their relatively higher cost. Apart from these two the pig-irons produced in England are usually designated as common pig, sometimes given the county or town in which it is produced or the trade name under which it is known. In Scotland, apart from hematite, the pig-iron produced is known as Scotch pig, together frequently with the trade name. English pig-irons vary much in their qualities, but, with few exceptions, they are not very strong. They generally possess good machining qualities, and are, as a rule, high in phosphorus contents, which increases their fluidity, enables dross to rise, and helps to eliminate blowholes. Scotch pig is moderately strong. It possesses an open grain, and has consequently good machining qualities. It is moderately high in silicon, and is capable of taking up much scrap. Special pig-irons are also produced having special qualities suitable for particular work, such as special cylinder pig, glazy pig high in silicon contents, and ferro-silicon or ferro-manganese pigs, but invariably the cost of these is relatively higher than ordinary pig-irons, and commercial considerations usually necessitate that the use of special pig-irons must be kept low. With scrap the quality must be largely determined by fracture, but the purpose for which the scrap metal was originally used is a good guide in deciding the category it should occupy. Thus cylinder scrap is usually hard and tough and difficult to machine, machinery scrap is of moderate strength and machines well, light scrap that is old or broken castings that have been made from soft high silicon metal and high in phosphorus should not enter into the composition for important work. It is generally used in conjunction with soft pig for similar work to that for which it has previously been used, or for work that does not require strength.

This method of determining the varying qualities of the metal from which mixtures are required to be made, although practised to a considerable extent, has many disadvantages. After long experience, many foundrymen possess remarkable skill in compounding suitable mixtures from which good results are obtained. Dependence is invariably placed upon certain brands and numbers of pig-iron, and as long as these are available the mixtures are made up to conform, within reasonable limits, to previous mixtures for work of a similar character, but should the particular brands not be available it is a more difficult problem to obtain the desired composition, and some experimental mixtures are frequently unavoidable. Under such conditions it is not possible to repeat mixtures that have been used some time previously with any degree of accuracy, unless it is a very common one in the foundry. With this method the foundry depends largely upon the skill of one man, and however skilful he may be, the results are uncertain, because cast iron may have a similar fracture, but vary much in its physical characteristics. Even the composition of similar brands of pig of the same numbers varies from time to time, and special pig-irons are frequently stocked to obtain desirable results for good class work. The method is gradually giving way to the more scientific way, which depends upon the chemical analysis of the pig and scrap employed in the charge in order to obtain a metal of desirable analysis.

TABLE I.—*Chemical Analysis of Different Brands of Pig Iron.*

WEST COAST HEMATITES.

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.75	0.30	2.60	0.02	0.045	0.50
No. 2	3.50	0.46	2.40	0.03	0.045	0.50
No. 3	3.25	0.54	2.10	0.04	0.045	0.50
No. 4	2.80	1.00	1.65	0.10	0.045	0.50
No. 5	2.40	1.60	1.20	0.20	0.045	0.50
Mottled	1.60	1.95	0.90	0.25	0.045	0.20
White	Trace	3.25	0.65	0.30	0.045	0.10

FROM NATIVE ORES.

	G.C.	C.C.	Si.	S.	P.	Mn.
Special	3.75	0.30	2.60	0.02	0.02	0.50

EAST COAST HEMATITES—"SEATON."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.75	0.30	2.50	0.02	0.05	1.00
No. 2	3.52	0.45	2.25	0.03	0.05	1.00
No. 3	3.15	0.56	2.00	0.04	0.05	1.00
No. 4	2.75	1.00	1.50	0.10	0.05	1.00
No. 5	2.45	1.55	1.00	0.20	0.05	0.75
Mottled	1.5	2.05	0.75	0.25	0.05	0.50
White	Trace	3.15	0.65	0.30	0.05	0.50
Special No. 1	3.52	0.30	2.50	0.015	0.03	1.00
,, No. 2	3.35	0.40	2.25	0.02	0.03	1.00
,, No. 3	3.00	0.50	2.00	0.025	0.03	1.00

SCOTCH PIG IRON—"CARRON."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.50	0.14	2.80	0.035	0.880	1.45
No. 2	3.37	0.25	2.275	0.045	0.907	1.45
No. 3 Soft	3.28	0.18	2.65	0.038	0.902	1.40
No. 3 Foundry	3.35	0.20	2.15	0.055	0.907	1.31
No. 3 Close	3.17	0.28	1.75	0.050	0.905	1.42
No. 4.	3.16	0.29	1.57	0.060	0.905	1.45

YORKSHIRE IRONS—"CLARENCE."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.03	0.30	3.17	0.03	1.60	0.50
No. 3	3.05	0.30	2.80	0.03	1.57	0.60
No. 4 Foundry	2.99	0.43	2.24	0.06	1.54	0.52
No. 4 Forge	2.75	0.55	1.85	0.10	1.56	0.50
Mottled	1.49	1.65	1.27	0.18	1.51	0.40
White	0.10	3.10	0.88	0.28	1.57	0.38

DERBYSHIRE IRONS.—"RENISHAW."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.41	Trace	2.939	0.036	1.68	0.362
No. 2	3.26	0.179	2.146	0.034	1.62	0.707
No. 3	3.85	0.112	2.333	0.024	1.581	0.572
No. 4 Foundry	3.30	0.225	2.099	0.053	1.771	0.647
Close Forge	2.80	0.33	1.819	0.079	1.730	0.520
Mottled	1.55	1.56	1.200	0.200	1.500	0.350
White	0.10	2.65	0.450	0.250	1.350	0.250
Glazy	3.45	Trace	4.500	0.070	1.600	0.610

LEICESTERSHIRE AND DISTRICT IRONS—"HOLWELL."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 Foundry	3.35	—	2.612	0.022	1.190	0.49
No. 2 ,, ...	3.65	—	2.473	0.036	1.173	0.403
No. 3 ,, ...	3.85	—	2.379	0.041	1.190	0.403
No. 4 ,, ...	3.35	—	2.333	0.047	1.255	0.389
No. 4 Forge	2.97	—	2.331	0.056	1.088	0.484
No. 5 ,, ...	1.75	—	1.376	0.062	0.929	0.245
Mottled	1.54	—	1.261	0.225	0.970	0.217
White	0.84	—	1.049	0.305	0.907	0.188
Glazy	2.5	—	4.850	0.028	1.285	0.532

LINCOLNSHIRE IRON—"REDBOURNE."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 3 Foundry	3.100	0.56	2.751	0.038	1.326	1.680
No. 4 ,, ...	2.816	0.751	2.610	0.045	1.318	1.589
Grey Forge	2.525	0.895	2.508	0.056	1.316	1.456
No. 4 Close	2.459	0.945	2.452	0.059	1.296	1.344
Mottled	1.480	1.520	1.325	0.100	1.296	1.130
White	0.675	2.285	0.450	0.155	1.295	1.100

STAFFORDSHIRE IRON (COLD BLAST)—"GRAZEBROOK."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.07	—	1.48	0.03	0.43	0.96
No. 2	3.04	—	1.27	0.04	0.34	0.80
No. 3	3.12	—	1.16	0.05	0.44	0.14
No. 4	3.03	—	0.83	0.04	0.31	0.27
No. 5	2.81	—	0.57	0.06	0.29	0.13

Determining the Composition by Chemical Analysis.

This method is undoubtedly the most satisfactory method used in conjunction with physical tests. The services of a qualified metallurgist are invaluable, not to take charge of the foundry, but to co-operate with the foundry foreman in obtaining desirable results. It must be remembered that to obtain castings of a suitable metal judgment is required to determine mixtures, and the practice in the foundry should be such as to give the best conditions for the mixture used. Making up charges to suit a certain chemical analysis when the composition of the various brands of pig and scrap iron are known may involve additional expense, but if the advantages of this method are considerable the compensations it offers make it acceptable. It offers facilities for dealing satisfactorily with a more varied assortment of castings and in determining the composition of metal to suit them with greater accuracy than is possible with the fracture method. Cheaper pig-irons can be used, the necessity for special and, incidentally, more expensive pig-irons being reduced and better advantage can be taken from scrap because its composition can be determined. The risks in compounding a mixture are less, and any faults in the composition that may result can be traced more readily. Mixtures that give best results for special work can be tabulated and similar mixtures made at any future date. This method also enables progressive experimental work being carried on with that degree of accuracy that gives confidence in the results. With this method the analyses of the different pig and scrap used must be ascertained before a definite charge can be made up and the opportunity is taken to give the chemical analysis of a number of different brands of pig-iron in order that the student will be able to appreciate the value of the method. It must be remembered that the analyses of pig-irons of similar brands and number vary, and therefore the analyses that follow must only be taken as the approximate composition of different brands. These analyses given in Table I. were given by Adamson before the Sheffield Metallurgical Society.

"Moulders" of the Industry.—No. 15.

Mr. J. E. Fletcher, M.I.Mech.E.

Mr. J. E. Fletcher has had a lifelong connection with the foundry industry. He was trained in Sheffield, at the Central School and Firth College, and he followed up his early studies by a scientific training at the Royal College of Science and School of Mines.

Mr. Fletcher was apprenticed with the Savile Street Foundry and Engineering Company, of Sheffield, where he specialised on the foundry side, working as a moulder, and was later given charge of the steel and iron foundries. As chief draughtsman in the same works he had experience in the designing of plant for ore preparation, for grinding machinery, and for colliery plants, especially in blowing and pumping machinery.

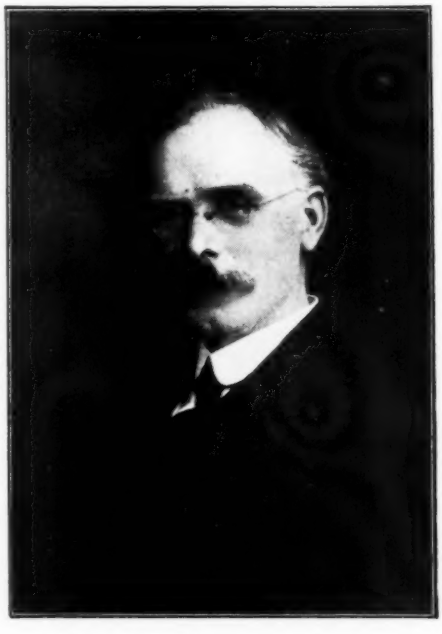
His further association with the Clay Cross Company brought him into touch with iron and steel works plant. Later he joined the works staff of Messrs. Thomas First & Sons, Limited, of Sheffield, and at the Norfolk Works was appointed steel-foundry manager, where he was closely associated with the development of the open-hearth and forging departments. He later became foundry manager in the works of Messrs. Cammell Laird & Company, Limited, and finally had charge of the iron and steel foundries, melting shops, forges, tyre and spring works there.

Whilst associated with the late Mr. Frederic Stubbs, Wh.Sc., then general manager of Messrs. Cammell's works at Grimesthorpe, he had a long experience in ferrous alloys research, especially in connection with chilled castings in iron and steel, and was repeatedly abroad in France and Germany during the development of the Harmet fluid compression of steel, and of the Krupp armour treatment processes. He had early experience in the heat treatment of both cast iron and steel and in the determination of the electrical and magnetic properties of steel and iron, being associated with the experiments of Dr. Hopkinson in some of the earliest researches as carried out in actual steel works on magnetic permeability and hysterisis.

When later connected with the Messrs. Hall's Patent Anchor Company, Mr. Fletcher had an active interest in the development of cast-steel anchors, and patented an improved form of anchor, which is used by the principal navies and shipping companies throughout the world.

Since 1905 Mr. Fletcher has been associated with the iron and steel industry in the Black Country as consulting engineer and metallurgical adviser to Messrs. N. Hingley & Sons, Limited, of the Netherton Ironworks, Dudley, and also in private practice. During the whole of this period he has been associated with iron, steel and malleable cast-iron foundry practice, together with that of the blast furnace and wrought iron manufacture.

As an enthusiast in the development of scientific methods in the foundry industry, Mr. Fletcher has read a number of Papers on such subjects as the design of castings, cupola and blast-furnace practice, the cooling of metals in the mould, moulding sands, and the function of working slags in ferrous processes. Mr. Fletcher is a member of many technical institutions, including the Institute of Mechanical Engineers and the Institute of British Foundrymen. He is a Past-President of the Staffordshire Iron and Steel Institute, a member of several B.E.S.A. committees representing the



MR. J. E. FLETCHER, M.I.Mech.E.

South Staffordshire Ironmasters' Association, a member of Iron and Steel Institute committees dealing with steel, analytical standards, and foundry matters.

He has actively assisted in the development of research in the foundry and wrought-iron industries, having acted as Director of Research during the first two years of the British Cast Iron Research Association's activities, and as a member of the Council of that Association. In the matter of wrought iron Mr. Fletcher, as technical adviser of the British Wrought Iron Manufacturers' Research Association, has been directing researches on puddling methods.

At the present time, apart from conducting foundry tests on a number of moulding sands and fireclays from recently discovered areas, in conjunction with Professor Boswell and other geologists, he is provisionally taking care of the technical side of the British Cast Iron Research Association.

As a member of the Faraday Society, he is interested in the developments of the higher physical branches of metallurgical science, recognising that the truly practical man must be a student of both pure and applied science if he is to take his proper place in the foundry industry.

Assembling a Metallurgical Laboratory.

By Richard Rimbach.*

In most cases the space allotted to the laboratory, its layout and equipment is left in the hands of an engineer or architect, rather than a chemist or metallurgist. In that case an inquiry is sent to supply houses as to the equipment they deem necessary. This in most cases causes the omission of apparatus and supplies, which are necessary and in many cases makes for the buying of equipment, which later cannot be used or which could have been built by the plant at a great saving of expense.

A grave error, which is as a rule committed, is the limitation of the laboratory as to size, allowing for no expansion. Generally when a company decides to have a laboratory, they allot a room or building for its use, which has outlived its usefulness or cannot be used for anything else. The furniture is of a makeshift character and the rooms are anything but attractive in appearance. This makes for work of the same character and is very discouraging to one undertaking the management of such a laboratory.

Installation and Space Necessary.

A metallurgical laboratory should consist of four rooms :—

1. A room for the preparation of tests and physical testing;
2. A chemical laboratory;
3. A balance room, microscopic room and office, and
4. A storage room.

The rooms should above all be light (except in the case of the storage room), large and free from dust. For this reason the laboratory should not be put too near the foundry or cleaning room, the power house or any other place where there is considerable dust; because dust not only spoils the apparatus of the laboratory, but also materially influences the accuracy of the analyses. The rooms should not be subjected to vibrations, for the analytical balances and the microscope are disturbed thereby.

If it is necessary to house the laboratory in a building, which is partly used for other purposes, the basement rooms are preferable, for the vibration there is minimum. Machine shop, 600 sq. ft.; analytical laboratory, 700 sq. ft.; balance room, etc., 200 sq. ft.; storage room, 200 sq. ft.

If testing machines are not to be installed, the machine shop need only have 250 sq. ft.; also if the microscope is omitted the balance room can be reduced to 150 sq. ft.

The Machine Shop and Testing Laboratory.

The equipment of this room should be : A drill press, a shaper, a tool grinder, a work bench, and a pulveriser. If physical tests are also to be made the following equipment must also be added : A lathe, a 50-ton universal testing machine, scleroscope, a Brinell machine, a power saw, heat treating furnaces, quenching tanks, cabinets for storing tools and test pieces and miscellaneous tools including : calipers, micrometers, steel scales, etc. The machines should all be direct motor driven.

If microscopic work is to be carried on by the laboratory, a polishing machine must be added to the equipment in this room.

The floor best suited for this room and in fact for all the rooms of the laboratory except the office, is wood block. Cement or concrete floors should not be considered.

The Analytical Laboratory.

Each chemist should have about 20 sq. ft. of desk space. If the desks are set up in the room a double-sided table 5 ft. wide is advisable. If set against the wall, the width found the best is 18 in. The cupboards and drawers of the desks will serve to hold the things which are needed daily (beakers, funnels, filter paper, etc.). The table top can be made of alberene stone (1¼ in. thick), slate, porcelain, ebonite board, polished oak or maple boards matched and set on edge, or pine boards with coverings of lead sheet (1/16-in. thick), linoleum or asbestos board (3/16-in. thick, painted with black acid-resisting paint). The alberene stone will be found to give the best service in point of sanitation, cleanliness, appearance and, if the length of service is considered, it is also reasonable in cost. When using desks set up in the centre of the laboratory, a trough can be run down the centre emptying into sinks or tubs at either or both ends of the desk. If the desks are placed around the walls, sinks should be placed at convenient intervals. If alberene stone is used for the top, a groove about 4 in. wide and beginning with a depth of ¾ in. at the sink and tapering down to ⅛ in., running along the wall will be found very useful especially in setting up for certain determinations; also when washing the top of the desk. The sinks should be large and deep (24 in. × 24 in. × 16 in.).

For each working place there should be from six to eight gas connections. Illuminating or producer gas may be used. It is advantageous to have compressed air (which is available in most plants)

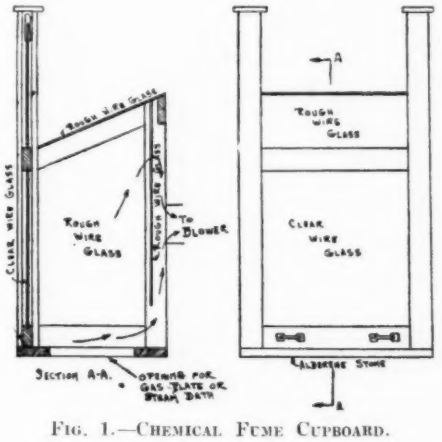


FIG. 1.—CHEMICAL FUME CUPBOARD.

connections, vacuum and numerous electric power plugs for the operation of motors, ovens and the like.

Between the windows, one or two shelves can be placed, directly above the tables, on which can be placed the reagent bottles, which are needed daily. The lowest shelf should be about 14 in. from the top of the table and the one above can be 14 in. from the first. The lower shelf can be made about 7 in. wide and upper 5 in. A glass plate ¼-in. thick placed on these shelves will prevent the chemicals from acting on the wood and thereby improve the appearance of the laboratory. Another shelf (heavy) about 1 ft. wide should be placed about 6 ft. above the desk, to carry the large bottles containing the reagents used as washes, also distilled water and the standard solutions. These reagents can be siphoned down to the table top with the aid of glass and rubber tubing. This is also clearly shown in one of the figures.

Sections of the desks should be set aside for sulphur and arsenic determinations, calorimeters, or filtering and others for carrying on titrations.

The fumes should be taken out of the laboratory by a hood. If sufficient space is available, it can be placed in the centre of the laboratory, thereby being made accessible from all sides; otherwise the hoods can be placed against the wall. The sides and top should be made of glass. The front should be arranged so that it can be closed by windows. The hoods should have from two to six compartments. The sketch of one compartment is given in Fig. 1. The gas hot-plate should be set flush with the desk top in one of these compartments. In another compartment of the hoods a stream or wash bath can be set up. Other compartments

* Formerly Metallurgist, Research Laboratory, Standard Steel Car Company, Butler, Pa.

can be used for hydrogen sulphide apparatus, and for the testing of fuels, oils and gases. All hot acid solutions should be kept under the hoods, and in this way the atmosphere of the laboratory can be kept free from acid fumes. The hood unit here shown is provided with a draft by means of the outlet in back. In some cases the natural draft is sufficient for sucking off the gases, but it is generally necessary to suck off the gases by an exhauster.

To clean the beakers, flasks, etc., hot water should be provided. A drain and peg board will

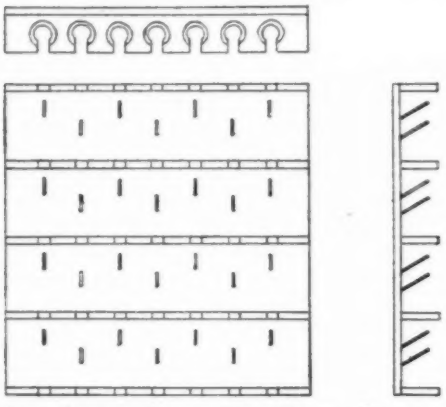


Fig. 2.—Sketch of Peg Board. It will carry 28 Beakers and 35 Flasks.

also materially assist in this regard. The sketch of such a board developed in the author's laboratory is shown in Fig. 2.

A large cabinet should also be provided to hold the seldom used chemicals and the glass or porcelain held in reserve. This cabinet as well as the desks and hoods can be constructed in the plant carpenter shop.

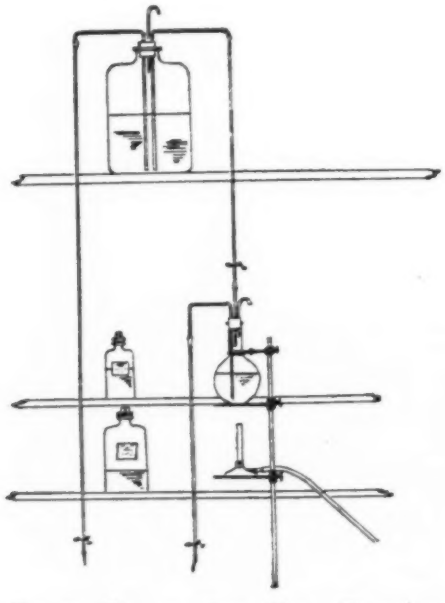


Fig. 3.—Hot and Cold Wash Water for Analytical Work. This Apparatus has the advantage that the only attention required is the filling of the large storage bottle. If used for alkali solutions, a soda lime guard must replace the bent tube on the large storage bottle.

For carrying on electrolytic analyses a special desk should be provided. The arrangement used in the author's laboratory was similar to that illustrated in Price and Meade "Technical Analysis of Brass." A single unit only was constructed of wood in place of alberene stone. Compressed air was blown through the solution to speed up the determination. The current necessary is direct current of about 20 volts. If direct current is available in the laboratory this can be converted to the lower voltage by using resistences. High voltage alternating current must be transformed into direct current of low voltage by generators or rectifiers, the choice of which depends on local conditions. Storage battery current may be used.

A shower bath head should be placed in the laboratory for extinguishing burning clothing or for diluting corrosive liquid splashes. It should be provided with a chain fastened to a quarter turn valve so that the water may be released without difficulty in time of accidents. No drain need be provided in the floor, as the use of this shower should be infrequent. Fire extinguishers and sand pails should also be provided in case of fire. The author has found a first-aid cabinet of material assistance in dealing with burns, cuts, etc.

The service is best piped above the tables and in the hoods. The piping system can comprise drains, hot, cold and distilled water, compressed air, vacuum, gas, high and low pressure steam and direct and alternating current electricity. All piping if exposed is easily accessible in case repairs are necessary. The author suggests painting all pipes and fittings with distinctive colours denoting their use. A suggested colour scheme is given below :—

Service.	Colour for Pipe	Colour for Fittings.
Acetylene	Black	Black
Compressed Air	Yellow	Black
Electricity	Black	Different colours for different currents and voltages
Gas	Blue	Grey
Hydrogen	Blue	Blue
Oxygen	Yellow	Yellow
Pyrometers	Black	Yellow
Steam, high pressure	Brown	Brown
Steam, low pressure	Brown	Black
Steam, exhaust, drips	Brown	Green
Steam, heating system	Brown	Bronze
Vacuum	Green	Green
Water, cold	White	White
Water, hot	White	Black
Water, distilled	Glass	Rubber
Water, fire	Red	Red
Waste and Sewage	Grey	Grey

Waste pipes and drains should be of high silicon iron. The service, which is not exposed, should be carried in a trench in the floor, which runs down the centre of the laboratory, and should be constructed so that it is easily accessible.

Balance Room and Office.

The balances can be set up on a wall shelf or on a balance table, the top of either should be made of birch strips, matched and glued.

The microscope is an important feature of the modern laboratory and if one is to be installed, provision must be made for setting it up. To complete the equipment of this room there should be a desk, chairs, a bookcase, file cases and a cabinet for storing valuable instruments and apparatus.

Storeroom.

It is advisable to have this room arranged similar to the storerooms in the plant, that is nothing should be drawn out of this room without making a record of it. After the laboratory has been in operation for some time, the person having charge of this room will know the amounts of the different supplies which will have to be kept on hand.

The still for distilled water can very handily be set up in this room.

The storeroom can also be made to serve as a dark-room in case of necessity.

According to the report of the Broken Hill Proprietary Company, Limited, a subsidiary company has been formed to utilise the blast furnace slag and tar for road-making material. A new company, comprising some leading English wire-rope manufacturers, has been formed for the purpose of manufacturing wire ropes in Australia adjacent to the Newcastle works. The company have interests in this undertaking. The directors decided that it was desirable to have a more direct interest in the coal supply, and steps are being taken in this direction; approximately 3,800 acres of good coal-bearing lands in the Maitland district have been purchased, and it is expected to commence developments of this property shortly; options secured over a large tract of land are under investigation.

Farington Steel Foundry.

By the courtesy of the management of Leyland Motors, Limited, our representative joined the members of the Halifax Metallurgical Society on a recent visit to the Farington Steelworks. Situated at Farington on the main line of the L. & N.W.R., the works represent the latest word in steel-foundry layout and equipment.

FIG. 1.—VIEW IN MAIN BAY, FARINGTON STEEL FOUNDRY.

The main building covering the foundry is 300 ft. long × 180 ft. wide, and is divided into three equal bays. In the north bay there are two cranes, in the centre bay three cranes, and in the south bay one crane. Ranging from 3 to 8 tons capacity, all these cranes were made by Herbert Morris. The building is particularly lofty and remarkably well lighted with north lights.

Steel is brought down in electric furnaces, of which two are in operation—a 3-ton Greaves-Etchells and a 2-ton Electro-Metals. These are placed at one end of the building, the power house being contained in an annexe on the opposite side of the wall.

At present, three to four heats per day are being cast, a certain percentage of castings being made for outside customers; the bulk of the castings produced, however, are absorbed in the Company's manufactures, more particularly the heavy commercial lorries.

The electric furnaces are giving remarkably good service. They are basic-lined and the bottoms last practically indefinitely, upwards of 800 heats having been made on the present lining. The roof of one of the furnaces had given an exceptional life in that it had run for 230 heats, and at the time of our representative's visit looked good for another 20-30 heats. Our representative was told that previous roofs have lasted for 205 and 203 heats—truly remarkable figures. The bricks used are best-quality silica and of British manufacture.

Moulding machines in service include Ajax, Osborne, Macdonald, and a special hydraulic press built to the B.T.-H. design. For the repetition work, called for in the lorry castings, metal patterns and core boxes are used.

The mould and core ovens are by August's Muffle Furnaces, Limited, the first being of the bogie type with lifting doors and the latter of the drawer type. The fronts of these last are insulated with slag wool, and when the drawer is fully opened the heat is retained in the oven by a casting fitted to the back of each drawer, which prevents the drawer itself being completely withdrawn from its position, and at the same time effectively seals the opening. As a matter of fact, the small cores are dried in these ovens in 10-15 minutes. The

FIG. 2.—SECTION OF CASTING FLOOR, FARINGTON STEEL FOUNDRY.

August furnace is on the H. M. Lane principle. Heated by hot air, the air passing over the top of the firebox, this system having been found in practice to entirely eliminate burnt cores and moulds. All cores are made of oil sand, as this has been found best suited to the intricate nature of the castings produced.

There are two Tilghman's sand-blast machines, whilst a third is in course of construction; there are also two sand-blast machines by Jackmans. Risers and feeders are removed by the oxy-hydrogen flame, the gases being electrolytically generated by a special plant built for the purpose.

The fettling plant comprises Noble and Lund band saws, swing grinders by Robsons, double-head grinders, etc., whilst pneumatic mains are laid completely round the shop. A portion of the north bay is laid off as an ironfoundry and equipped with Evans cupolas; this plant is engaged upon the production of cylinders, pistons, etc., in semi-steel.

Steam is raised in a battery of 10 Lancashire boilers fitted with Hodgkinson's mechanical stokers. Coal trucks are discharged by a tippler into a below-ground hopper, the coal being raised thence by bucket elevator which delivers on to a conveyor feeding the bunkers above the boilers. The tippler, elevator, and conveyor are of the Bennis manufacture.

At the Headquarters Works, interest of the visitors naturally centred round the heat-treatment shop. The plant in this shop consists of nine

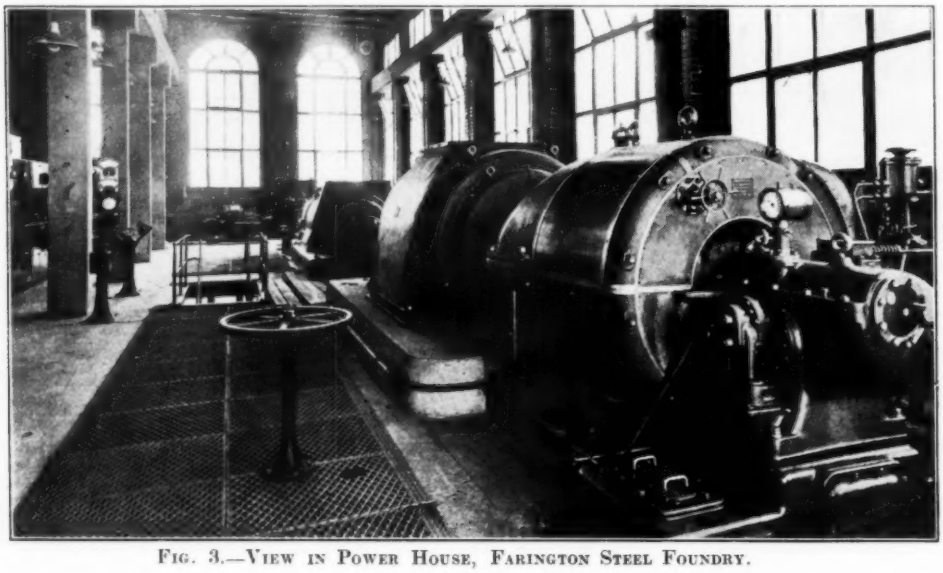


FIG. 3.—VIEW IN POWER HOUSE, FARINGTON STEEL FOUNDRY.

August's muffle furnaces ranging from 48 in. × 24 in. × 12 in. to 72 in. × 42 in. × 18 in. These are all coke-fired and records were seen on a Cambridge Recorder of furnaces running at 200 deg. C. and at 900 deg. C., thereby illustrating the remarkable flexibility of operation of this type of furnace. It was pointed out that it was quite an easy proposition to maintain these furnaces at any temperature from 200 deg. to 950 deg. C. with little or no variation for periods of upwards of

FIG. 4.—MOULD FOR HOLLOW-SPOKE WHEEL, FARINGTON STEEL FOUNDRY.

The power house attached to the west end of the foundry building is equipped with two turbo-generators, one of 3,000 kw. by the British Westinghouse, one 1,500 kw. by Fraser & Chalmers, and one small pilot set by Greenwood & Batley. Current is generated at 3,300 volts, and in addition to supplying the electric furnaces and foundry generally, a supply is taken to the Leyland Headquarters machine shops, etc., which are situated about a quarter mile away.

12 hours, and that the temperature throughout the muffle did not vary by more than 5 deg. C.

The operations in the heat-treatment shop consist of: (1) Carburising; (2) reheating for refining both core and case; (3) annealing and hardening all classes of mild and alloy steels. Each furnace is pyrometrically controlled, and in addition to the usual test-pieces for each batch for depth of case, fracture, etc., every individual case-hardened part is either file-tested or passed by the scleroscope.

In addition to the usual tensile and Izod test-pieces for each heat, every hardened and tempered part is Brinell-tested and has to come within very close limits before being passed through to the machine shops. It is recognised that the heat-treatment shop is a very vital factor, and consequently no effort has been spared to keep it ahead

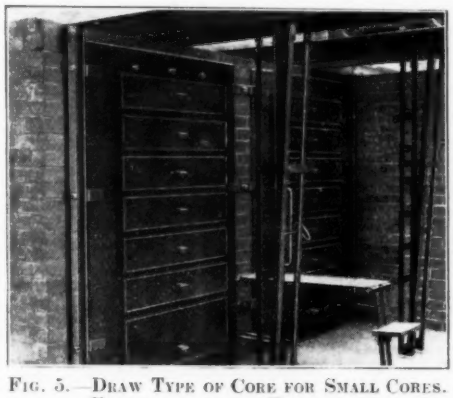


FIG. 5.—DRAW TYPE OF CORE FOR SMALL CORES. FARINGTON STEEL FOUNDRY.

of the times and up to the latest word in efficiency. The oil in the quenching tank is cooled by a special process, which ensures it being completely changed every 20 minutes. For quenching gear wheels which, after hardening, must run perfectly true to give the necessary quietness, etc., a Gleason hardening machine is employed, and this is found to prevent all distortion.

Honeycomb Structure in a Piece of Mild Steel.

A Saar steel works submitted to the Institute for Ferrous Metallurgy at Clausthal a piece of steel, illustrated in Figs. 1 and 2, and upon which Dr. Osann reports in a recent number of "Die Giesserei." The following information is given as to the origin of the sample:—

Whilst pouring of some dead mild steel, the metal ran over the top of the ingot mould and collected in a cavity on the floor. After cooling, the metal was removed from the floor and had the form of a disc about the size of a domestic plate. It exhibited the peculiar honeycomb structure shown in the illustrations, and in which tubes of polygonal section had formed. The shapes of the cross section were indiscriminately triangles, rectangles, polygons and hexagons.

The walls of the hollow spaces were formed of

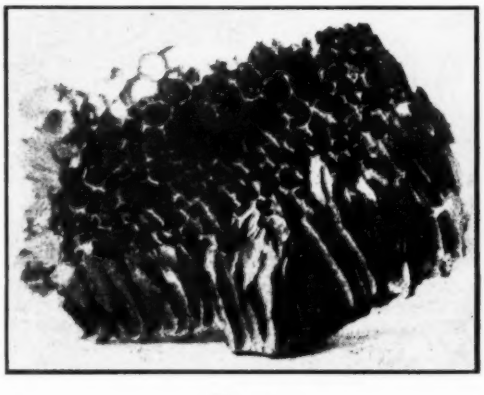


FIG. 1.

ingot iron of the thickness of paper. These hollows do not, however, reach to the base of the piece, which is quite solid. Fig. 2 shows, in section, this bottom layer of metal.

In the author's view, this peculiar structure is explained as follows:—

After a crust, about 5 mm. thick, had formed on the bottom due to cooling, gas started to generate, the intensity of which is only explained by the fact that considerable under-cooling had taken place. This gas generated was so violent and restrictive in its effects that the steel raised by it had not time to fall again, and so, assuming the form of the very thin walls referred to above, had solidified in that form. The canals formed by the gas were originally round, but afterwards assumed the polygonal shape. As an analogy to this, the reader should imagine two adjacent cylinders, which, owing to the expansion of the gases, tend to increase in diameter, so that the walls become flattened at the points of contact. This flattening occurs at various points on the periphery of the cylinder, thus producing the characteristic polygonal form of the cross-section.

It was not possible to trace the several steps that led up to the formation of this piece of metal in the first place, and it would have been very desirable to discover the cause for the extraordinary under-cooling. There is no doubt about the floor having been dry, for had it been wet, steam would have been generated and would have formed tubes open at both ends. It may also be assumed that the floor consisted of loose sand and was hot, thus enabling the ingot iron to remain liquid for some time and so favour under-cooling.

The tubular channels assume the same form as the subcutaneous blow-holes in an ingot, as their longitudinal direction is always perpendicular to the cooling surface. Only the liquid interior of the ingot is missing.

The partition walls of the honeycomb hollows

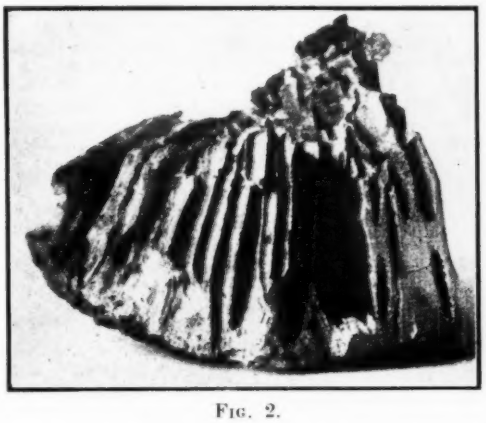


FIG. 2.

are as thin as paper at the top, and this is due to the floor of the foundry at that point not being flat but radiused. The radial gas channels were consequently forced upwards at the expense of the wall-thickness.

An analysis of the piece of metal showed: C 0.08 per cent., Si 0.18 per cent., Mn 0.65 per cent., P 0.135 per cent., S 0.048 per cent.

A.F.A. Committee on Specifications for Malleable Castings.

The report as given by Prof. Enrique Touceda follows:—

The last report of the Committee on Malleable Iron Castings contained the announcement that, at a joint meeting of A.S.T.M. Committee A-7 and this Committee, it was decided to recommend an alteration in the dimensions of the tensile test-bar; an increase in tensile requirements and a very slight addition to the text. These recommendations were presented and put into effect by the A.S.T.M. at their meeting in June last through their tentative specification, Proposed Revised Standard Specifications for Malleable Castings. Serial Designation: A47-22T.

In this tentative specification the ultimate strength per sq. in. has been raised from 20 to 22.3 tons, the elongation from 7.50 per cent. to 10.00 per cent. on 2 in., while the tensile test-bar has been shortened from an overall length of 12 in. to 7½ in., the gauge length, including fillets, from 6 in. to 2½ in., the diameter of gauge length and grip ends remaining the same.

A joint meeting of the A.S.T.M. Committee A-7 and this Committee has been called in order to consider, and, if thought expedient, approve any suggestions that may be offered at that time.

Quantity of Heat.

H. J. MAYBREY, B.A., D.I.C.

The amount of heat required to render a metal or alloy molten depends upon its mass, its specific heat, its latent heat of fusion and the range of temperature through which the metal must be heated, which, of course, depends almost entirely upon the melting point of the metal. It cannot be said that any one of these properties of the metal is of greater importance than another in determining the quantity of heat.

Yet it often occurs that those engaged in melting metals vaguely imagine that the amount of heat required to melt a metal is some simple function of its mass and the melting point. A little reflection will, of course, convince them that this is not the case and that these other factors of specific heat and latent heat play very important parts. It often is the case that the higher the melting point of the metal the greater is the amount of heat required to melt a potful. This is not, however, necessarily so.

Certainly a metal of high melting point requires a high furnace-temperature to melt it. A high temperature, however, does not always require a large quantity of heat to maintain itself. For example, the temperature of the filament of an ordinary electric-light bulb is extremely high. It is a temperature considerably higher than that which the brassfounder uses to melt his alloy. Yet it would be ridiculous to compare the heating power of the electric-light filament with those of the brassfounders' furnace! This all seems very obvious, but the distinction between temperature and quantity of heat is not always quite easy to visualise. The same confusion often exists in the minds of people between *voltage* and the quantity of electrical energy.

This question of the quantity of heat required to melt a metal is one of the greatest importance to foundries. Heat has to be paid for, and low melting costs all help to cheapen the product.

It is very interesting to compare the quantities of heat required just to melt a given volume when different metals are under consideration. Most of the metals in use commercially are alloys. Unfortunately, in the case of alloys it is almost an impossibility to calculate the quantity of heat required. The thermal properties of alloys are not known sufficiently well to give definite figures for specific heats and latent heats. Moreover, most alloys have no definite melting point, but rather a melting range. The very interesting comparison between, say, cast iron and 60/40 brass cannot then be made here. However, a very effective comparison can be made between four metals, all melted in commercial practice, one heavy, one rather heavy, one light and one ultra light. These are copper, zinc, aluminium and magnesium.

Let it be supposed that the pot holds nearly 2 cub. ft. of metal. In the metric system 50,000 cubic centimetres is nearly 2 cub. ft. For the purposes of comparison certain conditions must be stated. For example, it is presumed, in each case, that the temperature of the metal before melting is that of the foundry, say 25 deg. C. Again, it is sufficient just to melt the whole block and no more.

As an explanation, the heat unit is the quantity of heat required to raise the temperature of one gramme of water by one degree Centigrade. It is termed a *calorie*. It can be seen that it is not an enormous quantity of heat!

Now the density of copper is 8.93, so that the weight of 50,000 cubic centimetres is 50,000 × 8.93 grammes.

The average specific heat of copper between 25 deg. C. and the melting point, 1,080 deg. C., is 0.105.

Therefore, the number of calories required to heat the quantity of metal from 25 deg. C. to 1,080 deg. C. is:—

$$50{,}000 \times 8.93 \times 0.105 \times (1{,}080 - 25)$$
$$= 49{,}470{,}000 \text{ calories.}$$

The metal being at the melting point and the latent heat of fusion of copper being 43, it requires, to render the solid metal just molten:—

$$50{,}000 \times 8.93 \times 43 \text{ calories}$$
$$= 19{,}210{,}000 \text{ calories.}$$

So that, in all, 49,470,000, plus 19,210,000, *i.e.*, 67,680,000 calories, are required, just to melt the potful of metal starting from 25 deg. C.

Zinc has a density of 7.0, a specific heat of 0.107 (average between 25 deg. C. and melting point of 420 deg. C.), and a latent heat of fusion of 28.

Then the number of calories required to heat the block of zinc from 25 deg. C. to 420 deg C. is:—

$$50{,}000 \times 7.0 \times 0.107 \times (420 - 25)$$
$$= 14{,}790{,}000 \text{ calories.}$$

More calories are required actually to make the zinc liquid, *i.e.*, 50,000 × 7.0 × 28.

$$= 9{,}810{,}000 \text{ calories.}$$

In all 24,600,000 calories.

The density of aluminium is 2.65, its specific heat average between 25 deg. C., and the melting point, 657 deg. C., is 0.264, and its latent heat of fusion is 78.

In this case the total number of calories required is:—

$$50{,}000 \times 2.65 \times 0.264 \times (657 - 25)$$
$$+ 50{,}000 \times 2.65 \times 78$$
$$= 22{,}110{,}000 + 10{,}034{,}000$$
$$= 32{,}144{,}000 \text{ calories.}$$

Magnesium has a density of 1.74, average specific heat between 25 deg. C. and the melting point 651 deg. C. is 0.241; its latent heat of fusion is 50.

Thus the total number of calories required is:—

$$50{,}000 \times 1.74 \times 0.241 \times (651 - 25)$$
$$+ 50{,}000 \times 1.74 \times 50$$
$$= 13{,}120{,}000 + 4{,}350{,}000$$
$$+ 17{,}470{,}000.$$

Thus it will be seen that to heat and melt equal volumes of 50,000 cubic centimetres of metal very different quantities of heat are required, having no definite relationship to the melting point of the metal. It is interesting to note that although the melting points of the metals are almost identical, it takes nearly twice as much heat to melt aluminium as it takes to melt magnesium.

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

To the Editor of THE FOUNDRY TRADE JOURNAL.

A Foundry Historical Note.

SIR,—The following announcement, originally inserted in the "Sheffield Independent" one hundred years ago, on August 23, 1823, was reproduced as an interesting extract on August 23, 1923, in the same newspaper:—

"Workmen Wanted."

"Smiths and stove grate fitters, of sober habits, should apply to Newton, Scott, Chambers & Company," Thorncliffe Iron Works, near Sheffield, where they will meet with liberal encouragement.

"A number of replies were received at the works this morning, several of the applicants averring that they had "never touched beer in their lives."

Stove grates are still made here, but the majority of our smiths are engaged in our constructional steelwork department, and work, for the most part, on a material not discovered until many years after the above announcement.—Yours, etc.,

For NEWTON CHAMBERS & COMPANY, LIMITED,
RICHARD MILLS.

MR. J. H. RIDSDALE, blast-furnace manager to Palmers Shipbuilding & Iron Company, Limited, Jarrow, who has secured an appointment under the Ebbw Vale Steel, Iron & Coal Company, Limited, has been the recipient of a presentation from the officials and men. Mr. H. W. Doncaster, steelworks testhouse manager, who has obtained an appointment at the Tata Iron & Steel Works, India, has been presented with a gold watch.

Eliminating Unseen Wastes of the Foundry.*

By E. S. CARMAN.†

The nations of the world point to America as being an exceptionally wasteful and extravagant country, and as such is rushing headlong into the time when all American industries will be handicapped by the lack of materials with which to continue to provide for her ever-increasing industries and to supply a constantly growing population.

Waste is in evidence on every hand, from the largest and best-managed industry to the smallest and most poverty-stricken home; and no line of industry is exempt either in the supplying of raw materials or in the labour consumed in its manufacture. American forests are being consumed four and one-half times faster than their growth, and, at the present rate of consumption, seventy years hence will find America without forests. An exceptionally large amount of forest consumption is wasted.

Industry in many lines is beginning an intensive campaign for the elimination of waste, but before wastes can be eliminated, they must be discovered and pointed out. The Federated American Engineering Societies have contributed a valuable service by the thorough manner in which a well-organised committee carried on a thorough investigation in several industries to ascertain the proportional value of the wastes existing. The facts contained in this report were of a startling nature.‡

In attempts to eliminate waste, it is natural that it should begin with those wastes that are easily observed and outstanding in their appearance. It is, of course, essential that those wastes be eliminated, but it is also as truly essential to eliminate the unseen wastes, for they are as truly wasteful as those that are easily observed.

Therefore, attention is directed to the unseen wastes in the foundry industry, and not only to the foundry waste occasioned by defective castings, or to the inefficiency caused by the lack of skilled workmanship, or the wasteful hours of the loafer, or the inadequate and oftentimes absurd methods of handling materials, but rather is attention directed to the tremendous amount of waste existing in the foundry operation due to the lack of a system that makes use of standardisation in (1) the manufacture of the pattern, (2) the mounting of the pattern, and (3) flask sizes.

It only requires a moment's consideration of present-day methods to see clearly the exceptional wastes in:—(1) The initial cost of plant and equipment, (2) the continual daily loss in overhead charges, and (3) constant loss of labour involved in production.

Possibilities in Pattern Standardisation.

While these wastes take place in the foundry the burden occasioned by the waste falls entirely upon those plants that consume the output of the foundry, since the majority of foundries exist solely for the purpose of supplying other industries with castings for their productions. Therefore, it seems apparent that the wastes will continue just so long as those industries, that are consuming the output of the foundries, remain uninformed and blinded to the tremendous possibilities of savings to be made by the use of standardisation as applied to the patterns which they are furnishing the foundries with which to produce their castings. As an example, the manufacturer of machine tools brings out a new design of machine, turns the drawings over to the pattern-shop with no other instructions than to make patterns, and in a large majority of cases they are made without consultation with the foundry as to the best means of producing the castings. This same manufacturer, therefore, when purchasing castings, turns the patterns over to the foundry, and the foundry is forced to use them as they are received, and if they are not so made as to be produced on the moulding machine, they must be made by hand and at a considerably greater expense, and if the pattern fails to fit the flasks at hand, a new one must be made.

The additional expense in connection with the producing of the castings must eventually be borne by the manufacturer, and if, after he has secured his first lot of castings, he decides, either because of better price or other reasons, to place the patterns in another foundry, this second foundry, upon receipt of the patterns, will have to go through the same expensive routine as did the first one, the cost of which, in this case the same as in the first, must eventually be borne by the manufacturer. If the original pattern has not been mounted on a plate for machine moulding, there is considerable waste connected with the short life of the pattern, since it is conceded that loose and unmounted patterns deteriorate more rapidly than when mounted.

It was with a knowledge of the facts as above set forth that a committee was organised, by the societies of the industries interested, to make a thorough study of the many problems involved and, prepare a classification and standardisation of all the factors entering into the elimination of the unseen wastes.

Plan to Study Pattern Standardisation.

The committee has adopted a line of procedure as set forth in the following:—

(1) *Pattern-Making.*—(*a*) Uniform colour scheme for the marking of all patterns to indicate cores, stop-offs, machine surfaces, rough castings; (*b*) core print tapers; (*c*) drafts; (*d*) shrinkage; (*e*) marking.

(2) *Mounting the Pattern.*—(*a*) Mounting the pattern to the pattern plate so that the transfer could be made from one plate to another without re-alignment; (*b*) flask-pin sizes for given sizes of plates; (*c*) thickness of plates.

(3) *Flask Sizes.*—(*a*) Classify according to:—1. Steel plants; 2, grey-iron plants; 3, malleable plants; 4, brass plants; 5, aluminium plants; (*b*) classify as to type of machine to be used for moulding; (*c*) classify as to jobbing or production; (*d*) flask sizes (1, inside dimensions); (*e*) uniform style of design (1, dimension of sections).

A careful study of this outline will disclose the fact that the result of this investigation will produce tabulated standards applicable to the five different classes of foundries, and that, when these standards are used by the manufacturer in the making and mounting of his patterns, they will be interchangeable with the standard flasks in not only one foundry, but in any foundry to which he may send his patterns.

It is obvious that then the moving of patterns from one foundry to another will not involve the additional expense incident to the preparation for the making of the moulds, etc. These standards will also reduce to a minimum the number of flasks with which the foundry will be equipped, and make possible for the foundry to purchase standardised flask equipment such as can be used for any of the jobs coming into the foundry. It is essential, with the growing scarcity of materials and ever-present labour shortage, that haste be made in the preparation of these proposed standards.

It is believed that the industry will readily accept standards in this line, and that their use will mean to the foundry industry a saving in trouble, time and money, and will produce results which will be comparable to the adoption and general use of such standards as taps, dies, bolts, bolt heads, twist drills, reamers, gear, teeth, shafting, pulley, etc.

* From the Bulletin of the American Foundrymen's Association.

† Chairman Joint Committee on Pattern Standardisation.

‡ "The Elimination of Waste in Industry," McGraw-Hill Publishing Co., New York.

Vanadium in South Africa.—Vanadium ore is found in very few countries. The bulk is mined in Peru by the Vanadium Corporation of America. The latest report is that the F. T. Blane Mining Company, Limited, Ottoshoop, Transvaal, have dispatched two shipments of vanadinite concentrate from their Kaffirskraal Vanadium Mine. The shipments were of 25 and 30 tons respectively, and the concentrate in each case averaged about 13 per cent. of vanadic acid. These are the first considerable shipments of vanadium ore from the Union of South Africa.

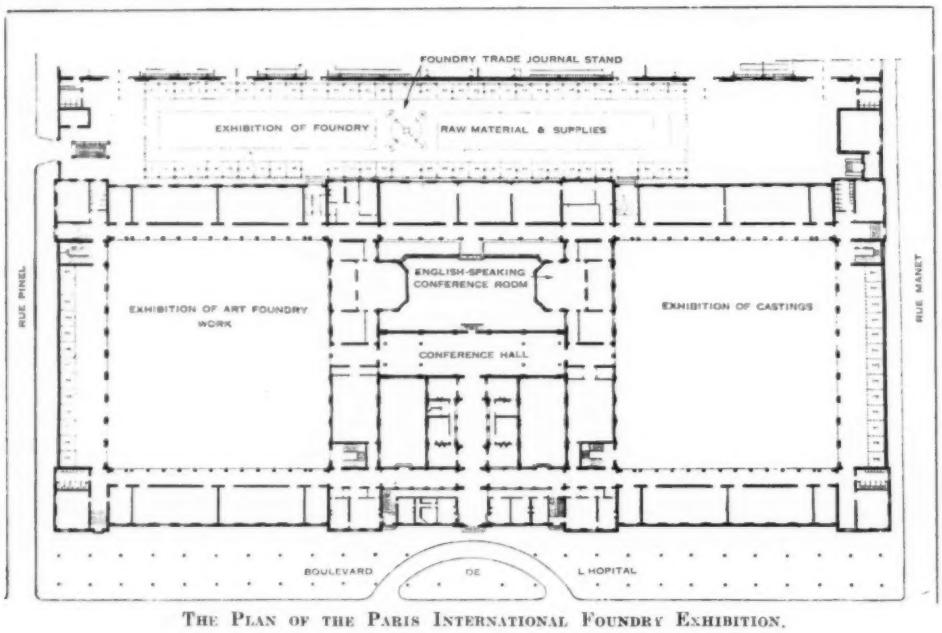
The Paris Foundry Exhibition.

This exhibition, which opened last Sunday at the Ecole d'Arts et Metiers, 151, Boulevard de l'Hôpital, is a thoroughly representative foundry exhibition of a distinctly international character. There are French, British, Belgian and American exhibits. Additionally at the school, there is the best equipped teaching foundry in France, and perhaps the best in England. The system followed rather resembles that of the Loughborough Engineering College, and includes the complete manufacture of various machines of commerce. By this is meant that the patterns are made, the moulds constructed, the castings poured, fettled, machined and assembled by the students themselves. Apart from exhibits of a commercial character, there is much space occupied by art castings and other finished products of the foundry.

Amongst the principal exhibits we note the following:—

Bonvillain et Ronceray, Choisy le Roi, near Paris.

This firm, who trade in England as the Universal System of Machine Moulding, have built up an international reputation as designers of moulding machines. These machines form their principal exhibits. They are shown in operation, the power being furnished by a pump working at 750 lbs. per sq. in. pressure in conjunction with a P4 type accumulator. The pump takes 3 h.p. and can work six to eight machines.



THE PLAN OF THE PARIS INTERNATIONAL FOUNDRY EXHIBITION.

Amongst the machines exhibited are the following types:—

A new type and design of roll-over moulding machine, known as the ER3 type, which deals very successfully with deep sides of moulds, with large pockets of sand, and almost entirely eliminates gaggers. During the Exhibition it will be working on the drag side of a British standard axle-box.

The EJ3 type machine has also been redesigned, and is shown in connection with the above machine, moulding the cope side of the axle-box. An important feature of this machine is that an arrangement is fitted permitting several jolts to be made before the squeezing is commenced, thus getting both jolting and squeezing.

A SA3 assembling machine is shown closing the axle-box moulds made on the ER3 and EJ3 machines, and pushing the moulds completely through the moulding box so that castings may be done without a moulding box—a system different from snap-flask work.

The JH3 and JH2 types of hydraulic jolting machines are novel innovations for which patents are pending. The valves for the machines are opened by means of a very small sewing-machine motor. They are much more easily controlled than air-operated jolting machines, and the stroke of the table can be varied from a tremble to violent impact blows to suit the class of work to be done. The former type lifts 6 cwts. and the latter 2 tons.

The well-known DF4 hydraulic moulding machine has been re-designed. It is a machine capable of giving very large outputs: it is putting down regularly in between 300 and 400 complete moulds per day. It rams the top and bottom moulds simultaneously, withdraws the pattern plate, closes the mould on the machine, and eventually pushes the mould completely through the boxes, thus enabling castings to be done without boxes. One of its very interesting features is that this output is obtained by a girl and a lad without any special exertion. There is no hard work in connection with it, as the machine does everything except putting sand on the machine and laying down the moulds on the floor. The makers claim that the speed has never yet been equalled by any other type of machine for flat work under similar conditions of serving the machine.

The A15 type of moulding machine has several new features for which patents are pending. It is the old type of A5 machine fitted with a down-sand frame, which is a novel device for quickly ramming moulds, especially for deep work, to the same degree of intensity as may be required. This is a most interesting development.

The R15 type of moulding machine is used for making the drag side of the mould with large pockets of sand, and is therefore a roll-over type.

In an entirely new pattern of a self-emptying sand mill, for which patents are pending, the usual pan is done away with. There is simply a plate, which revolves at a definite speed around a central axis, the weight being supported by three rollers. Two mullers are provided with special means to maintain them above the level of the plate when the mill is empty, thus avoiding crushing the sand grains and taking power when the machine is not working. Special cutters are provided for cutting the cake made by the rollers into ribs, which are pushed to the next roller by convenient scrapers.

A new type of vertical disintegrator for which patents are pending is also being shown. It is a simple and convenient machine, not liable to break, and arranged to be either fixed or moved on wheels.

A rotary portable sieve presents several interest-

ing features, as it can be worked in any position where there is an electric wall plug. It is electrically operated by means of a motor, and whilst all the sand passes through the screen, all stones and rubbish are sent into the back portion of the machine.

The Bonvillain core sand mixer, which is already well known, is also being shown.

"Phixine" is a new product for binding silica sand, and is self-drying. This is a revolution in the core-making methods. During the Exhibition a girl will make "Phixine" cores on the request of visitors, who will be able to take away the dried cores before leaving.

In the Educational section of the Exhibition Messrs. Bonvillain & Ronceray are exhibiting a transverse testing machine of the Fremont type. This machine has been re-designed and is intended to deal with a small test-piece, 10 mm. by 8 mm., which can easily be cut out from a grey-iron casting.

Also, they show a testing machine for a shearing test on cast iron, again of the Fremont type. This machine, too, has been re-designed, and is intended for testing small pieces, either square 5 mm. by 5 mm., or round 5.64 mm. (25 sq. m.). This test-piece can be taken from practically any casting without spoiling it.

Apparati to control the ramming of moulds and the permeability of moulds will most certainly be of considerable interest, because they mark, without doubt, a step in the right direction. If one can control the above two factors many of the foundryman's difficulties will disappear.

S. A. des Anciens Etbs Ladreyt, 182, Boulevard Victor Hugo, Clichy (Seine).

This house is showing a 3-ton foundry ladle, the gearing of which is totally enclosed and cheaply lubricated. A number of shanks of varying capacity are also being exhibited. For the renovation of old sand, a machine suitable for small- and medium-sized foundries is being shown. It consists of two cylinders kept in contact by two adjustable springs, which allow of the passage, without harm, of any metal left in the sand. It is driven from fast and loose pulley through specially-designed and totally-enclosed gearing. Another interesting exhibit is a portable pneumatic riddle, the jarring of which is accomplished by piston working in a cylinder fixed on the apex of tripod. For the fettling shop, a number of modern sand-blast machines are being exhibited. Their type, E.G. 500, forms the basis of several machines. Sand is fed into a container, through a riddle, and passes an automatic valve, which is controlled by the incoming air cock, the closing of which instantly assures the flow of sand into

A 3-TON LADLE BY LADREYT ET CIE.

the reservoir. During working, the special cock allows the quantity of sand to be regulated without touching the air cock. Obstructions are dealt with at the nozzle, which is so designed that it can be readily cleaned. A suitable compressor for use with this is also shown.

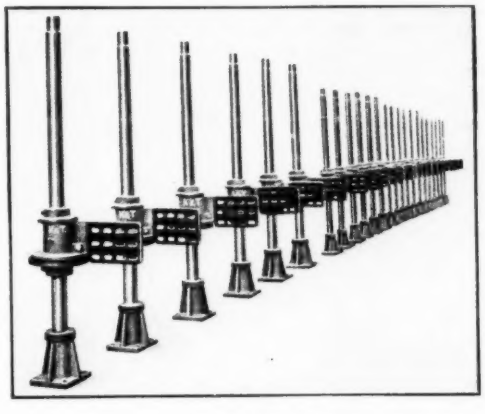
As a cabinet is really required with this apparatus, a modified machine is also shown, which includes above the previous apparatus a closed chamber. Another modification includes a 40-in. rotating table, supplied with a fixed and moveable jet. A novel sand-blast machine for cleaning files and tools is also included in the exhibit.

"The Foundry Trade Journal."

This JOURNAL, and its associated journals the "Iron and Coal Trades Review," "The Coal Merchant and Shipper," occupy a stand in the centre of the Exhibition. It will be in charge of Mons. Victor Truant. British and American visitors are requested to use this stand as an information bureau.

T. Ketin & F. Thiriart, Sclessin lez Liege, Belgium.

This well-known firm of Continental foundry equipment manufacturers for this Exhibition are showing, amongst other foundry equipment, a tilting, non-ferrous melting furnace, provided with an extended cover, which is swung away from the furnace for charging or teeming. Other exhibits



STRICKLES BY KETIN & THIRIART.

are a geared tumbling barrel, five-drawer portable core stove, and a portable mould drier. For this last item it is claimed that neither carbon monoxide nor dust is given off, and that the moulds are never burnt and can be dried after being cored up. A pneumatic riddle of substantial construction is also included. Perhaps their most interesting exhibit is a portable baby cupola. It is capable of melting about 750 lbs. per hour. One model, complete with motor and blower, is mounted on a wheeled bogey. For experimental, tramway, and emergency work it has a distinctly useful sphere.

A requisite which is rarely stocked in Great Britain by the important supply houses is a complete strickle. As shown by our illustration, the apparatus consists of cast-iron base, finished with a conical hole to take the upright, which is grooved the whole of its length. The arm is firmly fixed at the required height by a set-screw. The arm is arranged for the easy fitting of any type of strickle pattern.

A self-emptying sand mill provided with two conical rollers, one being ribbed along its length and the other across its length. This seems a novel and useful development. A good type of geared ladles of three tons capacity complete the stand.

The firm is represented in Great Britain by Messrs. John MacDonald & Company, of Pollokshaws, Glasgow.

British and Continental Traders, Limited, 50, High Holborn, London, W.C.1.

This concern, who have large business connections in France, are showing special pig-irons for both malleable and grey iron work. Mr. H. Shillitoe will be present at the stand during the Conference.

Glaenzer et Perrand, 18, Rue Faubourg du Temple, Paris, 11.

Besides being sole manufacturers and licensees for the American "Nicholls" jar-ramming machine, they also specialise in the manufacture of sand mills of the type incorporating on grooved tone smooth roller. In fact, sand-preparing machinery of all types is included in their manufactures. For this purpose, they make a belt-driven jar riddle, which essentially consists of a rectangular inclined riddle which allows the sand to pass through to a plane inclined in the opposite

XUM

direction to the riddle, thus passing the good material to the back of the machine and the discard to the front. Another type of riddle is also shown which is of the octagonal suspended rotary type. It is made in two types—a stationary belt-driven arrangement and a portable electrically-driven construction. A sand-aerating machine is a further speciality shown. It is made according to the "Carr" patents. On page 17 of the catalogue 5,211, they describe diagrammatically their suggestions of a semi-automatic sand plant to deal with 2½ cub. metres per hour. The old sand is first passed through a magnetic separator, then the sand mill, after which it meets with new sand and coal dust, or the like, in a combined screw conveyor and mixer installed at a lower level. Leaving this machine, a bucket elevator passes the sand into the aerator, which on discharge is ready for the moulder.

Messrs. Glaenzer et Perrand have no British representatives.

Kittel and Company, Limited, 8, Rue de Madrid, Paris.

The French house of this well-known London company are showing Frodair and other brands of pig-iron.

S. A. L'Avebene, 13, Rue d'Aguesseau, Paris.

Avebene is one of the best known core oils on the Continent. It is handled in this country by the General Refractories Company, of Kelham Island, Sheffield.

J. Cury et Fils and Martin, 1, Rue Nouvelle, Paris, 9.

This firm manufacture grey and malleable iron and brass castings, and are showing machinery and motor-cylinder castings from grey iron and numerous small castings and test-pieces from malleable. A number of foundry trucks and photographs of foundry cranes are being shown. The firm has no representation in Great Britain.

S. A. des Usines de St. Marie et Gravign, 1, Rue du Colonel Renard, Paris, 8.

This concern has foundries at St. Dizier in the North and Hęches in the Midi of France, and specialises in malleable-iron castings for the railway, motor and agricultural industries, and are showing examples of their products. The analysis of their iron, they state, is as follows:—C.C., 3.5; Si, 0.20; S., trace; P., trace to 0.02; and Mn, 0.05 per cent. This iron is exhibited as pigs weighing from 20 to 22 lbs., notched to make pieces weighing 10 lbs., this size being small enough to prevent scaffolding. The utility of the pig for malleable castings is demonstrated by the exhibition of test-pieces and the like. Large-sized chaplets are also a speciality of this firm. Whilst they have no actual agency in Great Britain, they have a special department for foreign business in the Paris office.

Ph. Dannely, 6, Rue Pascal, Montrouge.

Mr. Dannely is a foundry owner who has designed a special teeming apparatus. It presents several novel features, and is well worth inspection. The patents are not yet exploited in this country.

British Pig-Irons, Limited, 45, Rue de la Bienfaisance, Paris.

This concern, who are the sole concessionaires for the Midland Coke & Iron Company, are showing a range of cold blast and various varieties of British pig-irons. Both Major Tavenor and Mr. Willis will be at the stand for the benefit of non-French speaking visitors.

Allied Machinery Company de France, 19, Rue de Recroy, Paris.

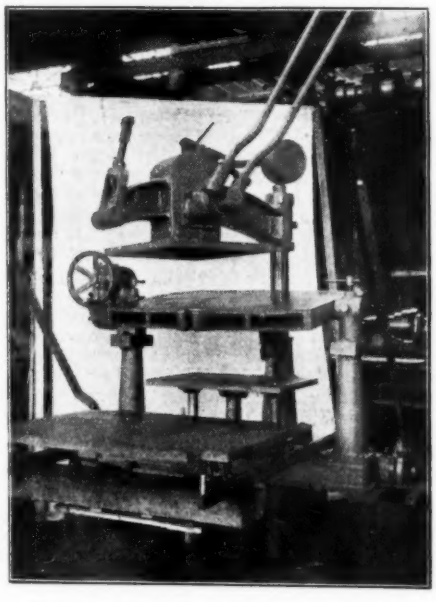
This firm is showing the Osborn (American) moulding machines, of which they are the agents for France. These machines are well known to British foundrymen, except, perhaps, type 421, which jar rams, and mechanically strips by the turn-over method. The shipping is regulated according to the depth of the box. It includes an arrangement which maintains the working of vibrators whenever the box is in contact with the table.

Georges Piron, 5 Rue Gretry, Paris.

Visitors may find much to interest them in this exhibit, as the firm conduct a large business as general foundry supplies and equipment manufacturers. Moulding machines, cupolas, ladles, drying stoves and sand mills are amongst their manufactures.

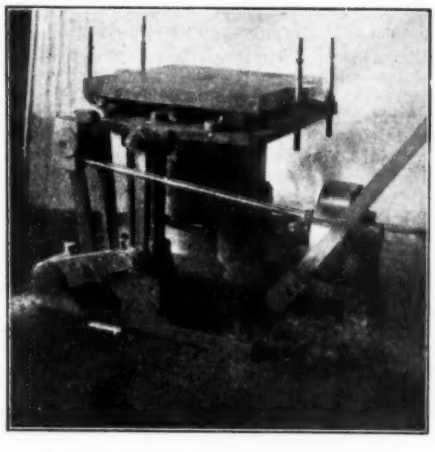
Societe des Etablissements A. Utard, Longeville-en-Barrois, Meuse.

This house, though not so well known in Great Britain, is renowned throughout the Continent.



HIGH PRESSURE TURNOVER MOULDING MACHINE BY MESSRS. UTARD.

They are said to have more than 7,000 machines at work. All their machines are hand-operated. Their latest types are the M.R.I. and R.I.A.; the former is a turnover machine, whilst the



MECHANICALLY OPERATED JAR-RAMMING MACHINE BY MESSRS. UTARD ET CIE.

latter rams the cope with a single movement without any preliminary tucking round. They are also showing a jar ram machine.

Fenwick Freres et Cie, 8, Rue de Rocroy, Paris.

This firm represents the Tabor machine, which is handled in Great Britain by Messrs. MacNab & Company, Limited, of 56, Eagle Street, Southampton Row, and the machine, therefore, is well known to our readers.

Henry Hamelle, 21, Boulevard Jules Ferry, Paris, 11.

This firm are showing Invaria metal, an alloy which has been specially prepared for metal patterns. It is made in two grades, the better being No. 1, which, it is claimed, has practically no contraction. No. 2 has a price advantage, but still low contraction. The melting points are respectively 325 and 320 deg. C., whilst the specific gravities are returned at 7.2 and 9.9. Special points are made of the absence of brittleness, ease of machining, hardness sufficiently high as to prevent damage through careless handling in the foundry, and extreme fluidity.

VISIT OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.—*Continued.*

the big things so splendidly, that we hardly know how to express our appreciation of you." (Applause.)

"My impressions of your country are such that I have been amazed. We have known of your greatness, but now we have felt it. When I go back to America I am going to tell my friends that Pittsburgh is only the Sheffield of America." (Applause.)

Buying Pig-iron to Analysis.

Dr. Richard Moldenke, proposing the toast of "The Institute of British Foundrymen," said he was pleased to see at that board Sir Robert Hadfield, who was as well known in America as he was in England. They had met there that night to express their great pleasure at being amongst their fellow foundrymen in England, and he wished to express their cordial appreciation for all the kindness that had been shown to them since they arrived in the country. Sir Robert Hadfield, he desired to make known, was a gentleman who had been the turning-point in his life. He had been engaged on some work, when he received an encouraging letter from Sir Robert which had made all the difference in the world to him. As secretary of the American Foundrymen's Association for many years he had watched the growth of the British Institute from its beginning to its present great position. It might perhaps seem peculiar to them that in their branches they did not seem to do so much good as they did in England. The explanation was that America was a very large country, and the distances between place and place were very great compared with England. For that reason they were not able to exchange views with the same freedom, though the local branches took care of their industry in a way.

Test-bar Specifications.

Proceeding, Dr. Moldenke referred to the conservative attitude of British foundrymen towards their craft in the years preceding the war, mentioning one instance—namely, the purchase of pig by fracture instead of by analysis. American foundrymen, he pointed out, had insisted upon getting what they wanted. But to-day, he knew that they had the opportunity of buying by analysis, but they still wanted the one thing—the arrangement or the settlement of tolerances. When they did that they would get their share of the trade of the world That was one of the points which he was sure would come up for discussion at the Paris meeting. Since the war, however, he was glad to see that they had absolutely changed in their attitude. But he was afraid in that respect that the pendulum was inclined to swing too far—that they were inclined to go too fast and thereby add to the troubles of the foundrymen. They were forcing scientific application in their foundries at the expense of a good deal of their comfort.

Illustrating what he meant by that, Dr. Moldenke instanced the fact that their customers in the late 'nineties insisted upon specification. The American foundrymen got busy, and if they looked at their specifications they would observe that they were very simple. In fact, they would find that they were not of much use, because, having set the standard, their customers were now quite satisfied, and they did not buy under the specification except where life and car wheels were involved. The British foundrymen, on the other hand, in grey-iron castings had gone very nicely into the subject. They had been going very strong, but he thought they had better be a little careful before adopting things finally, otherwise he feared their chickens would come home to roost.

Alluding to the international position of their trade, he suggested that they should try to get on to simple lines for the general run of work. The American foundrymen, he said, wanted to work with their British and French comrades as closely as possible, and he believed on these lines they could accomplish something, not only for themselves, but for the world.

During their stay in Sheffield several excursions were arranged for the visitors to see both North Derbyshire and the Dukeries. Unfortunately, the weather prevented the tea offered to the ladies by Mrs. Tom Firth being taken in the garden, but an extremely enjoyable time was spent.

MANCHESTER VISIT.

The delegates of the American Foundrymen's Association were entertained by the National Ironfounding Employers' Federation, at a "welcome" dinner, in the Midland Hotel, Manchester, last Friday, August 31. Mr. Oliver Stubbs, the President of the Federation, was in the chair, and among the guests were Colonel W. F. Cheesewright, Mr. W. H. Hollinworth, the Secretary of the Institute of British Foundrymen; Mr. R. A. Miles and Mr. T. Makemson, president and secretary of the Lancashire branch; Mr. E. H. Broughall, vice-president, I.B.F.; and Mr. V. C. Faulkner. Sir Allan Smith, Chairman of the Engineering National Employers' Federation, was unable to be present, and his place was taken by the secretary of the Federation, Mr. James Brown. Owing to the indisposition of the Lady Mayoress, the Lord Mayor of Manchester, Councillor Cundiff, was obliged to cancel his engagement, and the duty of responding to the toast of "Manchester" was allotted to Mr. B. Longbottom, the Chairman of the Engineering Section of the Manchester Chamber of Commerce and President of the British Electrical and Allied Manufacturers' Association. Among the American visitors Dr. Richard Moldenke was absent because he was fulfilling a lecture engagement at Sheffield, by giving to the members of the local branch a lecture on American Foundry Practice. In the course of the evening the Chairman read a letter from Lord Weir regretting very much his inability to be present, and also cablegrams from M. Ramas, conveying the cordial greetings of the French Association Technique to their British and American colleagues; from M. Leonard, President of the Belgian Association of Foundrymen, "Cordial greetings and best wishes for a successful finish of work in hand"; from C. E. Hoyt, of Chicago, "May contacts established result in better understanding between business men of the two nations"; from Mr. Backert, Cleveland, Ohio, "Mixture British, French, American Foundrymen will produce international amity surpassing results of deliberations world's politicians combined"; from Mr. J. A. Penton, also of Cleveland, "The more meetings of every kind held between Englishmen and Americans, the better for the entire world now and for ever. We are one in every thought, sentiment and ambition. May the bonds of our common heritage draw us tighter and tighter together with every succeeding year. Three cheers for the Union Jack and what it has meant to civilisation."

Manchester and C.I. Pipes.

After the toasts of "The King" and "The President of the United States" had been proposed by the Chairman and duly honoured, Mr. Walter Wood, of Philadelphia, proposed the toast of "Manchester." He said Manchester was the hub of a strong active industrial community. The strength and determination of her population had corrected the error of nature which left her at a distance from the sea and without a harbour. She had gone as far as Therlmere to get water to drink. Speaking as a manufacturer of cast iron pipes, he regretted that none of that water passed through his pipes, but he would say that to the credit of the Englishmen who made the pipes actually used, they were the best he had ever seen. Nearly sixty years ago a great struggle in the United States deprived Manchester of the cotton she required for her trade and the operatives in the mills suffered greatly, but they remained the friends of America and gave to her their sympathy in the struggle which was being waged for human rights. Along with their admiration of Manchester as a strong virile city, Americans should cherish the recollection of the sympathy which was extended to their country in its great trouble.

Mr. B. Longbottom, in responding, said in gatherings of this nature they learned to know one another, and that helped towards the stabilisation which was needed in industry. Never before had the voice of industry been heard in the councils of this nation so frequently or with as much attention as it was to-day, and he believed that was true of other countries. Next year the British Electrical and Allied Manufacturers' Asso-

XUM

ciation would hold its first world conference and the American and Canadian programmes were being worked out now. That also would help to their understanding one another, and when they had their say in the nation's affairs, that good understanding would bring about stability and the peace which they all desired.

The Chairman, in proposing the toast of "The American Foundrymen's Association," said he had the pleasure of speaking to one of the toasts at the reception of the American visitors in London on the previous Monday, and he then had the opportunity of expressing his feelings. Mr. Clamer would agree that proof had been given of the high esteem in which American foundrymen were held by the foundry world in Great Britain. It was his earnest wish and would be his constant endeavour, that the foundrymen of the two countries should come together and co-operate in bringing about the world peace which was so much desired.

Mr. F. J. Taylor, a Vice-President of the National Ironfounding Employers' Federation, also spoke in support of the toast.

AMERICAN PRESIDENT'S REPLY.

Mr. G. H. Clamer, President of the American Foundrymen's Association, replied. He said since they landed in England they had been overwhelmed with hospitality. One of the first greetings came from Mr. Stubbs, who sent a telegram of welcome and expressed a hope that their meeting would further cement the good feelings which already existed. This hospitality, extended in such an English spirit, was greatly appreciated. In America they had no national association exactly like the National Ironfounding Employers' Federation of Great Britain, the function of which, he gathered, was to deal with labour problems. That distinguished it from the Institute of British Foundrymen and the American Foundrymen's Association, which dealt with the technical side of the industry. In 1776 the American Colonies broke their ties with the Mother Country by what might be regarded as an accident, or perchance it was fate. They seceded because of unfair treatment. The mother of King George III. was of German birth, and she brought her son up along lines of training and of thought which were more of German than of English origin, and when George III. imposed restrictions and taxes upon the commerce of the American Colonies it was resented. It was entirely contrary to the treatment given to English Colonies before or since, and the sentiment in England at that time was greatly divided. However, the King prevailed, the Revolutionary war was fought, and a Republican form of government was established in America. It was a question whether the progress made in America would not have been just as great, possibly greater, if the tie had never been broken. Would the interests of the world at large have been more greatly advanced if all the English-speaking peoples had remained under one Government? With their combined resources what a power they would have been for maintaining the peace of the world! Would the Germans have even thought that their "Kultur" could dominate the world? In this visit they had already seen Windsor Castle, Westminster Abbey, and other places, and they could understand the feeling of reverence with which an Englishman regarded these memorials of the historic past. He had been told that there was evidence of the same English trait in the industrial establishments of the country—that a piece of machinery was never scrapped until it was worn out—but his observations did not confirm that statement. At Hadfields, in Sheffield, he found the most modern, up-to-date, efficient machinery. It was true, however, that America was a new country and did not trace its continuous history back two thousand years. The minds of its people were always directed to that which was new, and when a new machine was presented to them their first calculation was: How soon will it pay for itself? If it would pay for itself in two years, or even four or five, it was regarded as a good investment, even if it involved the displacement and scrapping of other machinery which was comparatively new. He was told that during the war the British plants were equipped with the most modern resources, and that there had also been a change in the attitude of the workmen. That the plants were now running at slow production was a matter for regret, but he was confident that when they came to the end of the first ten years after the termination of the war it would be found that in that period there had been an advance equivalent to what took place in a similar period before the war.

In the main purpose of their visit to Europe the delegates of the American Foundrymen's Association were carrying out the wishes of Mr. Stubbs, as expressed in his telegram of welcome—namely, the further cementing of the good feelings which existed between them. But perhaps a more suitable term would be "welding," which signified a stronger bond than that of cementation. Therefore he would conclude by saying that their mission was to weld the good feelings which existed between British and American foundrymen. (Applause.)

Mr. J. Brown, in proposing the toast of "The Chairman," said no one had done as much as Mr. Stubbs to bring about the good feeling which had been referred to.

Visits and Excursions.

On Sunday the visitors were the guests of the Manchester and District Ironfounders' Association. They were taken to Chester, where luncheon was served at the Grosvenor Hotel. After an enjoyable trip on the river they returned to the hotel for dinner, and arrived back in Manchester at 10.20.

On Monday afternoon the visitors were conducted over the foundries of the Metropolitan-Vickers works at Trafford Park. The visitors were first shown the light foundry and the cupola plant. Here the perfection of the manufacture of resistance grids brought forward many compliments. For certain castings the speed of production was thought to excel those obtained in the States on similar work. The brassfoundry, where much interest was shown by the visitors in the waste metal reclamation plant, was next visited, and was followed by an inspection of the heavy foundries. Messrs. Jolley (foundry manager), Makemson, Phillips, and others acted as guides.

In the evening the local branch offered the visitors a high tea at the Victoria Hotel. Mr. R. A. Miles, the branch-president, occupied the chair. Speech-making had to be kept to a minimum, as the visitors were taken to a performance at the Manchester Hippodrome. Time was found, however, to present to Mr. Lehman, one of the visitors, a fountain pen on his attaining his majority.

On Tuesday afternoon the visitors left for Birmingham.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Foundry Technical Institute, Falkirk.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—I write to ask you kindly to correct an error in your issue of August 23.

In the article on Professor Campion, under "Moulders of the Industry," it is stated that owing to trade depression the scheme of the Foundry Technical Institute at Falkirk was abandoned last year. This is entirely erroneous. There has been no abandonment of the scheme, but on the contrary the Institute is in very active operation, with Mr. Henry Cowan, B.Sc., as the new Superintendent. It is doing much useful work, both of a private nature for the members and others, and in the way of research for the members collectively; also in the technical training of the younger workmen in the district.—Yours truly,

J. C. JEFFREY SMITH,
Chairman of Committee,
Foundry Technical Institute.

Falkirk,
September 3.

[We regret that the statement we made was incorrect, and tender to the Chairman and members of the Falkirk Technical Institute our apologies for any inconvenience that statement may have caused.—EDITOR.]

MACNAB & Co.

TABOR MOULDING MACHINES (TABOR PATENTS)

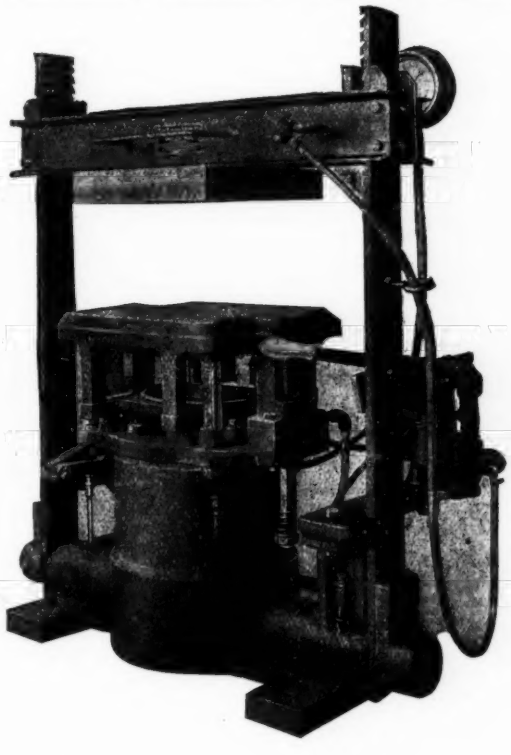
For Every Class of Work.

Pit Type and Portable Combination Shockless Jar Ramming Power Roll-over and Pattern Drawing Machines; Power Squeezing and Jar Squeezing Machines; Shockless Jarring Machines, etc., etc.

SPECIAL FEATURES AND ADVANTAGES:

Accurate Definite Draw with Permanent Accurate Alignment.

All Operations Controlled by One Lever.



Uniformity in size of Castings produced.

All Moulds squeezed alike to whatever Pressure Required.

Minimum Percentage of Wasters.

The above illustrates the TABOR POWER SQUEEZING "SPLIT PATTERN" MOULDING MACHINE, specially suitable for all small patterns which can be split in halves or for flat back work.

Capacities and Dimensions furnished upon application:

56/8, Eagle Street, Southampton Row, London, W.C.1.

Works: TOTTENHAM, LONDON, N.17.

Recommendations for Supplying Pig-iron on Analysis.

The following recommendations are contained in a letter sent on behalf of the American Society for Testing Materials by Dr. R. Moldenke and Mr. Walter Wood to Mr. Arthur Dorman, the President of the National Federation of Iron and Steel Manufacturers. It should be distinctly understood that the recommendations are only meant to apply to international business.

In the year 1906, the American Society for Testing Materials found it desirable to frame recommendations for the supply of pig-iron on analysis, in view of a pressing need that had developed.

In 1913, the International Association for Testing Materials framed proposals to extend the above practice so that it would be applicable to international trade.

In 1923, the Convention of the American Society for Testing Materials framed a carefully made revision of the specifications of 1906, which corresponds to the American practice that has developed during the intervening years.

The Cast Iron Division of that Society has empowered its officers to present the following for discussion before the ironmasters of Great Britain and the Continent:—

I.—Manufacture.

The pig-iron shall be clean, as free as possible from an excessive amount of dross and sand, and may be either sand or machine cast.

II.—Chemical Properties.

(*a*).—The pig-iron shall conform to the chemical requirements specified by the purchaser at the time of purchase, with the following permissible variations from the specified percentages in the case of pig-iron intended for the manufacture of grey-iron castings:—

Silicon, 0.25 above and below.
Sulphur, not over specified percentage.
Phosphorus, 0.15 above and below.
Manganese, 0.20 above and below.
Total carbon, not less than specified percentage.

(*b*).—In the case of pig-iron for making steel, malleable iron or special castings, a maximum percentage of phosphorus and either a maximum or minimum percentage of manganese may be specified.

III.—Sampling and Analysis.

(*a*).—In sampling, each truck load (or its equivalent) shall be considered as a unit.

(*b*).—One pig shall be taken to every four tons in the car, and they shall be chosen from different parts of the car as to secure, as nearly as possible, a sample representing the average quality of the iron.

(*c*).—The pigs thus taken shall be sampled by drilling, so as to represent fairly the composition of the pigs as cast.

(*d*).—An equal weight of the drillings from each pig shall be thoroughly mixed to make up the sample for analysis.

IV.—Inspection and Rejection.

In case of dispute, the sampling and analysis shall be made by an independent chemist, mutually agreed upon (if practicable, at the time the contract is made), whose decision shall be final. The cost of such re-sampling and re-analysis shall be borne by the party in error.

All pig-iron which fails to conform to these specifications shall be subject to rejection.

An Interesting Competition.

Messrs. Beecroft & Partners, Limited, foundry chemists, of Sheffield, are offering a three-guinea prize for the best slogan or catch phrase for an oil sand core oil which they have recently developed, details of which appear in the advertisement columns.

R. H. JACKSON, LIMITED, of 54/56, Cannon Street, Manchester, have removed to 1, Princess Street, Manchester.

Trade Talk.

HEDLEY, MOORWOOD & COMPANY, LIMITED, of the Foundrite Works, Pond Street, Sheffield, have removed to 21, Church Street, Sheffield.

HARLAND & WOLFF, LIMITED, have launched from their Govan shipyard three steel lighters for Elder, Dempster & Company, Limited.

F. REDDAWAY & COMPANY, LIMITED, belting manufacturers, etc., of Manchester, have removed their London office from 50, Lime Street, E.C.3, to Bush House, Aldwych, W.C.2.

THE UNDERFEED STOKER COMPANY, LIMITED, have lately taken orders for 75 travelling grate stokers, 31 Underfeed stokers, 2 air beaters, 4 ash conveyors, 3 arches, 1 coal conveyor, etc.

IMPERIAL ENGINEERING COMPANY, of 56, Darlington Street, Wolverhampton, have appointed Daniel Carmichael & Sons, 125, Howard Street, Glasgow, sole agents in Scotland and the North of England.

OWING to the expiration of lease, Francis Polden & Company, Limited, 17, Wells Street, W., have removed to more extensive premises adjoining their head offices, 56, Cannon Street, London, E.C., and a showroom for the display of electrical fittings, domestic appliances and accessories has been opened.

MR. F. V. TURNER, who has been for so many years connected with the engineering works of Henry Watson & Sons, Limited, Walker Gate, is severing his connection with that district, and is shortly sailing for Christchurch, New Zealand, Mr. Turner is going out to represent in New Zealand Richard Melhuish, Limited, and Dixon & Corbett and R. S. Newall & Company, Limited.

MESSRS. JOHN GRUNDY, LIMITED, of Parr Street, Tyldesley, have appointed Messrs. Moulding & Foundry Engineers, Limited, 28, Royal Exchange Square, Glasgow, to be sole agents for Scotland for the sale of "Hestia" core and mould drier. It is interesting to note that this firm has installed the "Hestia" system of core and mould drying at the works of Messrs. James Hodgkinson (Salford), Ltd., Pendleton.

Patents Abstract.

Particulars of complete specifications accepted, furnished by Mr. Eric Potter, patent agent, of 27, Chancery Lane, London, W.C.2, and Commerce Chambers, Parliament Street, Nottingham.

Printed copies of the specifications in the following list will be on sale to-day.

SCHWARTZ, H. A.—Method of and apparatus for casting metals. 181,338.

WOTTLE, H.—Manufacture of cast belt pulleys. 179,957.

MACDONALD & SON, LTD., J., and NEESHAM, J. B.—Moulding machine for foundry use. 202,074.

KUENRICH, P. R.—Electric furnaces. 202,127.

DAGOBERT TIMAR & CO., and SCHRODER, E.—Apparatus for heating forgings or the like by electricity. 202,211.

PRODOR SOC. ANON., and LEVY, DR. M.—Moulding of pipes and like hollow or solid articles. 202,248.

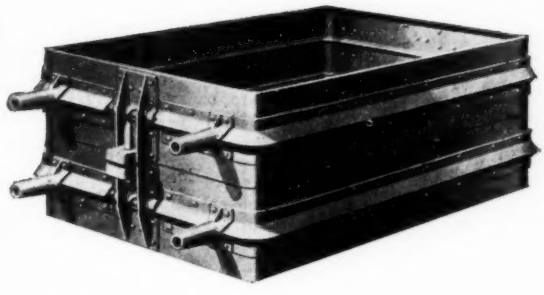
Institute Notes.

Messrs. Thos. Cook & Company announce that the joint party of Institute of British Foundrymen and the American Foundrymen's Association will travel by the first portion of the Continental Express, which leaves at 1.35 p.m. instead of at 2 p.m. as previously arranged.

Mr. H. G. Sommerfield, of Woodhouse Road, N.12, has been requested by the London Branch Council to act as honorary secretary for the coming session, as Mr. H. O. Slater finds that, owing to pressure of business, he will be unable to accept the office. Mr. Sommerfield is a member of many years' standing, but military services, and numerous prolonged visits to Scandinavia, where he is well known in foundry circles, prevented his regular attendance at meetings.

Mr. K. S. Jewson, a member of the London Branch, who, we regret to announce, will be in the Norwich and Norfolk Hospital until the end of the year, has changed his permanent address to 4, Cooper's Terrace, Scarning Road, Dereham, Norfolk.

Sterling



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IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—The close of the holiday month has so far had little stimulating influence on business in general in the pig-iron trade, and although there have been increased attendances in Tees-side markets the demand for Cleveland brands can hardly be described as much improved. The foundry-iron situation continues inanimate, but inquiries in circulation suggest increasing interest on the part of Scottish consumers. Export inquiry at the moment is extremely limited, and it would seem that there is not much to be hoped for in this connection while political and financial conditions on the Continent remain so precarious. Moreover, even at to-day's values hematite is cheaper than Cleveland foundry iron, and this acts as a further handicap to the latter, both in home and foreign markets. On 'Change this week No. 3 G.M.B. was offering at 98s. 6d. per ton. This brings Cleveland more nearly into competitive line with Midland descriptions, and should tend to have some effect upon inland sales. There is certainly a feeling that No. 3 is now at about rock-bottom, especially having regard to the persistently high cost of Durham fuel, and in view of the very restricted output of Cleveland any improvement in export demand might speedily turn the scale. But with trade conditions so uncertain consumers are following an extremely cautious policy. No. 1, although very scarce, can now be bought at 104s., No. 4 foundry is offered at 94s., and No. 4 forge at 92s. 6d. per ton.

Some improvement is to be noted this week in the conditions of the East Coast hematite market, the restriction of production having doubtless influenced a revival of interest in this section. Since June 30 eight furnaces on hematite have been put out of action, reducing the number in the North-East of England to 12, and the total number of furnaces now in blast to 40, of which 11 are on Cleveland iron and 17 on basic and special kinds of iron. But another and more important factor in the recent improvement is the cheapness of hematite compared with Cleveland. Many users, both at home and abroad, find hematite at least equally suitable for their purpose, and when, as it now happens, it is not only not at a substantial premium, but on the same level, it offers undoubted attractions. Hence a rather better demand, both for home and export, is reported, with the result that values are distinctly firmer. East Coast mixed numbers are still quoted at 98s. 6d., but some makers are disposed to hold out for 99s. to 100s. per ton. No. 1 is at a premium of 6d. to 1s. per ton. In the West Coast hematite market there is no change of prices, though a stiffening tendency is observable, and Bessemer mixed numbers are quoted still at £5 10s. per ton, delivered at Glasgow and Sheffield, and £5 13s., delivered at Birmingham and South Wales ports.

MANCHESTER.—Business in foundry iron in this district has now been reduced almost to retail proportions, transactions in the local market being usually confined to 10- and 20-ton lots, sufficient only to meet the most immediate needs of consumers. The basis price for Manchester foundry iron is now 92s. 6d. per ton on trucks at the furnaces, or, roughly, 100s. per ton delivered in this district. There are some Derbyshire furnaces still quoting 95s. on trucks, more or less theoretically, but it is not probable that these furnaces would actually refuse orders which come in at 92s. 6d.

THE MIDLANDS.—In this area, also, pig-iron producers are experiencing a rather sluggish demand, the output of local furnaces, although much restricted in volume, being more than sufficient to meet current demands. The chief obstacle to any cheapening of production is still attributable to the high prices now ruling for fuel; coke, it is reported, is to remain at 26s. at furnaces, which is a great deal too high under present conditions. It would still be dear at 20s., but apparently there is no hope of that. Presumably, as coke producers and furnace owners have had a recent conference, it is agreed that the volume of demand would be no larger, and profits no greater if there were a substantial reduction in coke prices; but it hardly seems questionable that in the long run cheap fuel, by enabling low prices to be quoted, will stimulate business. Quotations:—Northamptonshire No. 3 foundry, 90s. to 92s. 6d.; Derbyshire No. 3 foundry, 92s. 6d., all net, f.o.t. furnaces.

SCOTLAND.—The market for Scottish pig-iron is practically unchanged from the conditions noted in last week's report, the prevailing stagnation in the shipbuilding industry on Clydeside and the falling-off in export trade to the Continent having had a depressing effect upon every branch of local production. For No. 3 foundry quality pig the price quoted is round about 101s. per ton, but for any substantial orders doubtless the quotation would be shaded.

Finished Iron.

In this, as in other sections of the trade, conditions continue irregular, with demand still much below the actual capacity of manufacturers' resources, while there is keen competition in evidence for any business coming forward in the market. Marked bars are maintained at their recent standard, and, no doubt, there is some satisfaction in this solitary example of steadiness. The price may seem unduly high in comparison with other finished iron products (though we do not suggest that it is so), but, at any rate, the users are not left in doubt as to prices. They do know what they have to pay, and they may be fairly certain that the makers will not jump prices about in the middle of contracts. That in itself is sometimes regarded as an advantage. As far as other bars are concerned, and unmarked iron generally, conditions are extraordinarily poor; the industry is being badly starved.

Steel.

Although no material improvement has been noted since previously reported, current business is fairly well maintained, while inquiries and new contracts placed are in satisfactory volume for what is usually regarded as a quiet period of the year. The market for semi-products is, however, dull, though at Sheffield acid billets are if anything in slightly improved demand. In the market for alloys, ferro-manganese prices are maintained, and the damping down of one or two furnaces brings the supply more in line with the demand, which is not quite so heavy, either for domestic consumption or for export. America is still a moderate customer, and buying there in most of the alloys is confined to truck lots, and ferro-manganese price is, therefore, easy in consequence. The general tone of the tinplate market is fairly steady, although the business being done just now is not large. The inquiry is fair, but buyers are not disposed to cover anything but their actual early requirements, holding the opinion that lower quotations will be fixed after the end of September. Makers' prices for the standard sizes remain as follows:—IC, 14 by 20, 112 sheets, 108 lbs., 23s. 1½d. per box; IC, 28 by 20, 56 sheets, 108 lbs., 23s. 7½d. per box, with lights and crosses at the scheduled differences, net cash, f.o.b. Bristol Channel ports.

Scrap.

Reports from all the principal centres of consumption of scrap metal are to the unanimous effect that no improvement is perceptible in current demand, and that business everywhere is stagnant and unprofitable to dealers. In the South Wales district it is said that there is a little better demand for steel scrap, and up to 80s. per ton is offered for heavy furnace scrap by the consumers, while sellers are standing out for 85s. In Lancashire cast scrap is very plentiful and the consumption is low. The prices range from 77s. 6d. to 85s. per ton, and as they are roughly about £1 per ton below the prices for pig-iron there should be a much better demand, if the ironfounders were fully employed, but this class of work is not plentiful yet, although the trade does not seem to be quite so depressed as it was. Heavy cast-iron scrap is the only material which has, to any extent, held its position in Scotland, and prices still remain fairly firm. The demand is fairly good and supplies are short. Heavy machinery cast-iron scrap and scrap railway chairs run about 92s. 6d. to 95s. per ton, and ordinary cast-iron scrap 82s. 6d. per ton. Light metal and furnace firebars run about 62s. 6d. to 65s. per ton.

Metals.

Copper.—The tendency of values in the standard copper market recently has been distinctly on the down grade, and although the decline has not been by any means on a heavy scale the latest developments of the Continental political situation must have a further adverse effect upon business in general. American statistics now available indicate that while her total exports of copper to this country have fallen in recent months, as compared with 1922, exports for the six months are three times as great. This movement is significant as showing the large increase in consumption this year and the change in

(*Continued on page* 218.)

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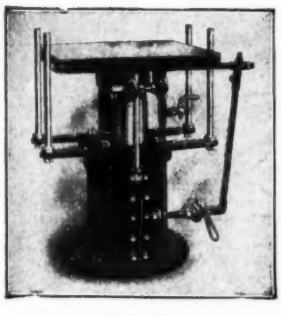

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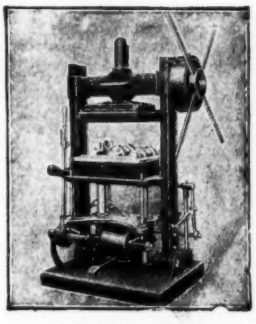

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IRON, STEEL AND METAL MARKETS—*continued.*

the main sources of our supplies. Whereas before the war 50 per cent. came from America, the proportion this year is 65 per cent. On the other hand, Australia, which used to send us 20 per cent., has dropped to 8½ per cent. Current quotations:—*Cash*: Thursday, £62 17s. 6d.; Friday, £62 12s. 6d.; Monday, £63 7s. 6d.; Tuesday, £64 5s.; Wednesday, £64 5s. *Three Months*: Thursday, £63 12s. 6d.; Friday, £63 7s. 6d.; Monday, £64 5s.; Tuesday, £65; Wednesday, £65.

Tin.—During the past week the market for standard tin was consistently firm, with values steadily on the up grade, influenced mainly, no doubt, by the increasing strength of the statistical position and freer buying on American account. The stocks of tin in Great Britain have fallen 53 tons to 3,606 tons, of which 1,737 tons are in London and 1,869 tons in Liverpool, and the general feeling is that the monthly statement will make a good showing and induce some covering. The supplies of both Straits or Banca tin remain restricted, so that holders here had no difficulty in realising a premium of fully £3 10s. a ton over the current value of standard tin. For the present operators seem inclined to mark time, pending consideration of the monthly returns. The discount on cash delivery has varied but little, now being 22s. 6d. a ton, and the fact that the stocks are tightly held may easily result in that discount being reduced. Current quotations:—*Cash*: Thursday, £193 17s. 6d.; Friday, £191 15s.; Monday, £194 15s.; Tuesday, £197 5s.; Wednesday, £198; *Three months*: Thursday, £195; Friday, £193; Monday, £195 15s.; Tuesday, £198 5s.; Wednesday, £199.

Spelter.—In the early part of last week the market for this metal continued active, with values advancing steadily, but a reaction followed, and since quotations have shown an irregular tendency. Rudolf Wolff & Company report that the Russian demand for zinc sheets appears to have been satisfied, but there is a better inquiry from other countries, and a fair business has been reported for galvanised sheets to China and Japan for forward deliveries. In spite of this, however, galvanisers in England are not purchasing on any large scale, having apparently fulfilled their present requirements. Current quotations:—*Ordinary*: Thursday, £33 10s.; Friday, £33 10s.; Monday, £33; Tuesday, £33 12s. 6d.; Wednesday, £33 15s.

Lead.—The market for soft foreign pig remains quietly steady, and in sympathy with other metals values have advanced. The demand from consumers in the United Kingdom shows some little improvement, while the Continental inquiry is also better. Supplies continue to arrive freely, and the demand is easily met. Current quotations:—*Soft foreign (prompt)*: Thursday, £24 15s.; Friday, £24 15s.; Monday, £25 2s. 6d.; Tuesday, £25 10s.; Wednesday, £25 17s. 6d.

Personal Paragraphs.

Mr. T. Woof has resigned his position on the board of directors of Alfred Herbert, Limited, Coventry.

Mr. D. Baker, manager of the Broken Hill Iron and Steel Works, is retiring, but will continue to serve the company in a consulting capacity. He will be succeeded by Mr. L. Bradford.

Mr. John Carson, manager of Harland & Wolff, Limited, Bootle, has again been elected chairman of the Mersey Ship Repairers' Federation.

Mr. D. Jenkins has relinquished his position as district manager at Swansea for the Metropolitan-Vickers Electrical Company, Limited, and has entered into partnership with P. J. Plevin & Partners, consulting engineers, of 4, Working Street, Cardiff.

Wills.

Wilson, G. H., of Huddersfield, iron merchant	£20,612
Payne, E. D., of 59, Calthorpe Road, Edgbaston, and of 102, Irving Street, Birmingham, brassfounder	£2,980
Hogg, J., of 8, Lovaine Terrace, North Shields, managing director of James Hogg & Company, Limited, brassfounders	£21,111

The partnership which has been carried on by Messrs. W. H. Brindley and G. H. White under the style of the St. Thomas General Engineers, at 40 and 42, St. Thomas Street, and at 57, Bailey Street, Sheffield, has been dissolved. In future the business will be carried on by Mr. W. H. Brindley.

Company News.

Scottish Iron & Steel Company, Limited.—Preference dividend, 6 per cent. for half-year.

North British Locomotive Company, Limited.—Preference dividend, 2½ per cent. for half-year.

Moulded Products, Limited, 122, Colmore Row, Birmingham.—Capital £5,000 in £1 shares.

John Varley, Limited, Waterloo Foundry, St. Helens, Lancs.—Capital £26,000 in £1 shares. Ironmasters.

Manganese Bronze and Brass Company, Limited.—Dividend on 6 per cent. preference shares will not be paid.

Engineering Units, Limited.—Capital £2,000. Solicitor: H. L. Wilson, Witten Lodge, Stoke, Coventry.

John Spencer & Sons, Limited.—Brought forward, £15,739; debit balance, £27,628; second half-year's dividend on preference shares passed.

Oriental Steel Company, Limited, 36, New Broad Street, London, E.C.—Capital £1,000 in £1 shares. Directors: H. E. Sayer and C. H. Shore.

Gardner White & Company, Limited, 20, Emersan Chambers, Blackett Street, Newcastle-on-Tyne.—Capital £7,000 in £1 shares. Iron merchants.

J. Challis & Son, Limited, 89, Camden Mews, London, N.W.1.—Capital £300 in £1 shares. Directors: W. J. Beatley, E. J. W. Challis and P. Waas.

J. & C. Bell, Limited, 122A, Pentonville Road, London, N.—Capital £2,000 in £1 shares. Engineers. Directors: G. B. Bell, J. A. Bell and H. L. Allensby.

Zwicky, Limited.—Capital £1,000. General engineers, manufacturers of machinery, etc. Solicitors: Richardson, Sowerby, Holden & Co., 5, John Street, Bedford Row, London, W.C.1.

Tavistock Engineering Company, Limited, 9, Johnston Street, London, W.11.—Capital £2,000 in £1 shares. Directors: F. P. Ayers (managing) and A. A. Smith. Secretary: E. Riches.

Dodds & Moate, Limited.—Capital £5,000 in £1 shares. General engineers. Directors: A. B. Dodds, Printing Office Street, Doncaster; H. Moate, A. B. Dodds, junr., A. Moate and W. Kirby.

Dreadnought Trading Company, Limited, 19, Palace Street, Market Street, Manchester.—Capital £500. Machinery and metal merchants. Directors: S. J. Barlow, Mrs. C. M. Statham and Miss E. E. Andrews.

Clayton & James, Limited, 31-33, High Holborn, London, W.C.—Capital £2,000. Machinery manufacturers and merchants, etc. Directors: F. Alton-Nagel, J. E. Burt, C. F. Dickson and F. H. Lightwood.

Tolley, Sons & Bostock, Limited.—Capital £10,000 in £1 shares, to acquire the business of ironmasters and steel manufacturers carried on by R. M. Tolley and W. H. Bostock under the style of Tolley, Son & Bostock at Darlaston, Stafford.

Gazette.

Bates & Scholes, Limited, Denton, engineers, in liquidation. Sir T. Smethurst, 26, Pall Mall, Manchester, has been appointed receiver. August 10.

Ebora Propeller Company, Limited, Kingston-on-Thames, in liquidation. S. Bennett, Eagle Chambers, Kingston-on-Thames, has been appointed receiver. August 15.

Dyffryn Works, Limited, Swansea, steel manufacturers, in liquidation. A. O. John, Central Buildings. Fisher Street, Swansea, has been appointed receiver. August 20.

H. J. Green, late Villa Road Ironworks, Oldham, and Boundary Garage, Failsworth, engineer, etc., is paying a second and final dividend, 1s. 2d., at 27, Brazennose Street, Manchester.

F. E. Ward, 162, Davyhulme Road, Stretford, Manchester, previously 77, Chorlton Road, Hulme, Manchester, and 31, Scarisbrick Avenue, Southport, estimating engineer, has been adjudicated bankrupt.

Trading in the style of Cowling & Scott, Messrs. H. J. Cowling and W. P. Scott, Stafford Road, Newport, mechanical engineers, have dissolved partnership. Debts by Mr. W. P. Scott, who continues the business.

L. M. Bell, trading as Broundell's Engineering Works, London Road, Faversham, engineer, is paying a first and final dividend of 1s. 5d., at Poppleton, Appleby & Hawkins', 4, Charterhouse Square, E.C., on September 10.

Trading in the style of Lambourne, Leslie & Co., A. W. Lambourne and J. P. Leslie, 168-161, Great Charles Street, Birmingham, constructional engineers' merchants and agents, have dissolved partnership. Debts by Mr. J. P. Leslie.

Proceedings in bankruptcy have been commenced in the case of A. E. West, L. K. West, and S. A. West, trading as A. E. West & Sons, 20, Shodfriars Lane, Boston, engineers. Examination, Municipal Buildings, Boston, October 8, at 12.30 p.m.